THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CX. No. 2450.] LONDON, APRIL 26, 1910. [62ND YEAR. PRICE 6d.

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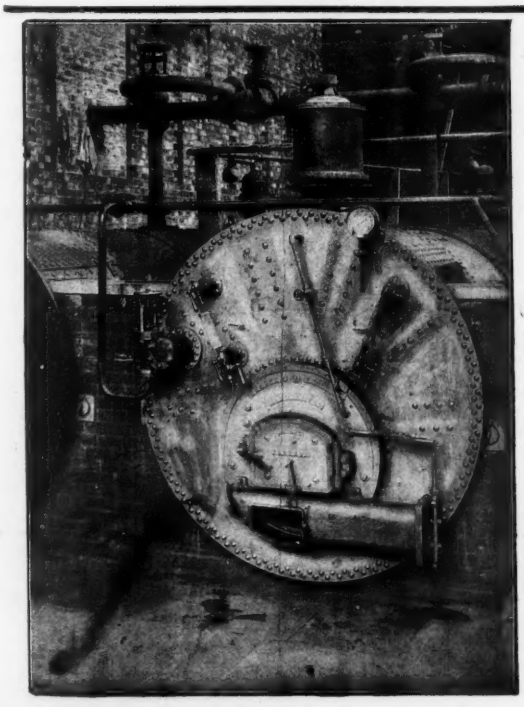

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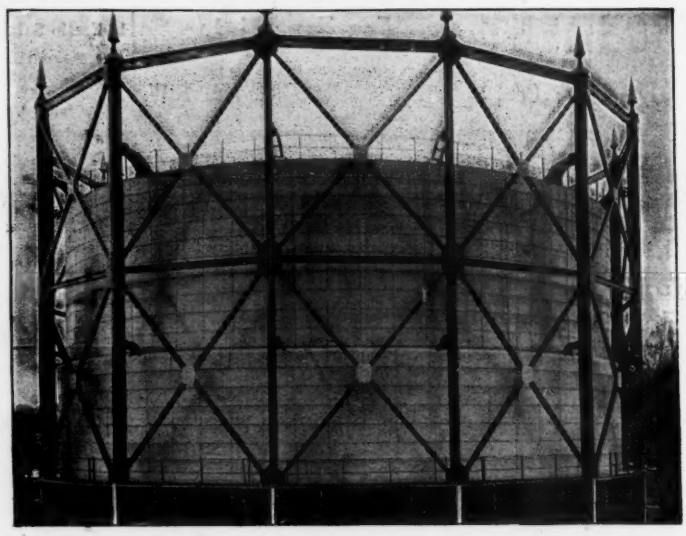

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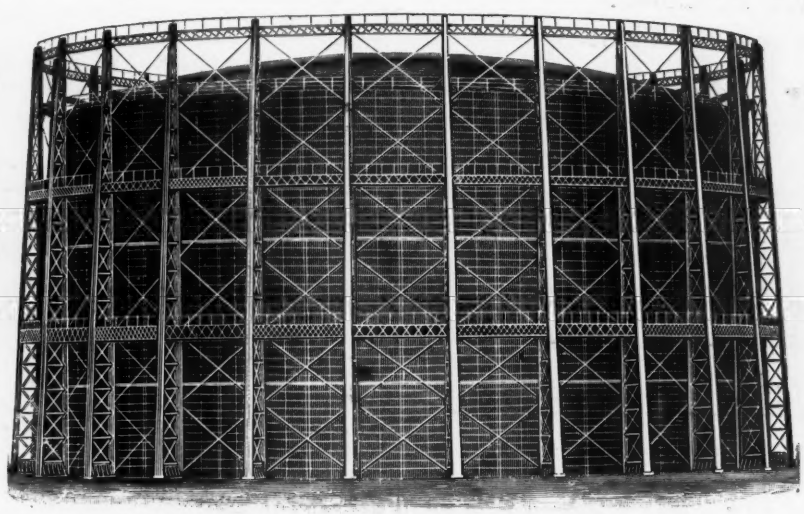

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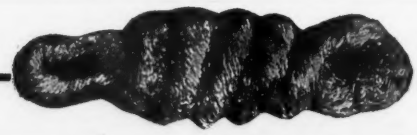

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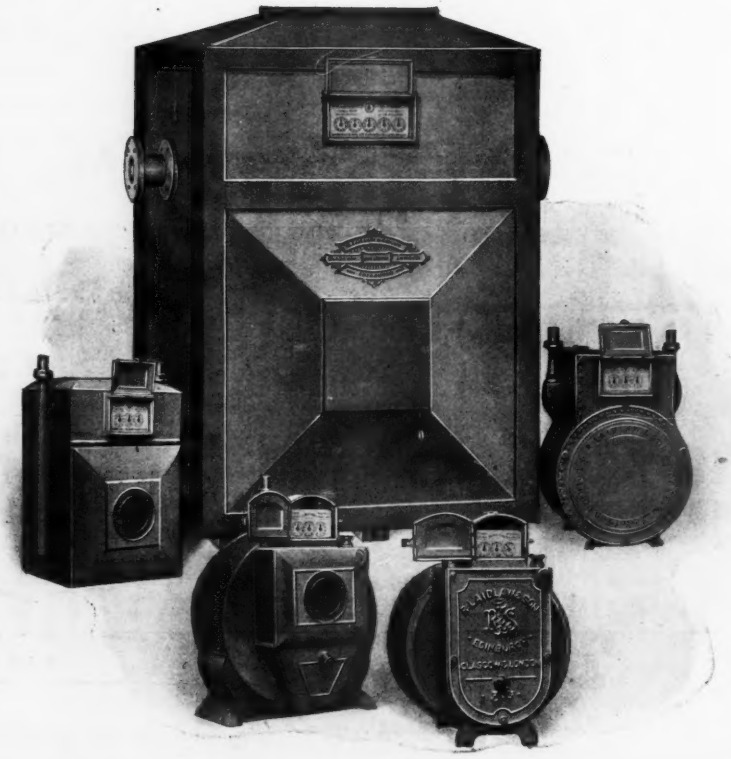

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Fig. 705. "SINGLE RAM" STEAM-PUMP.

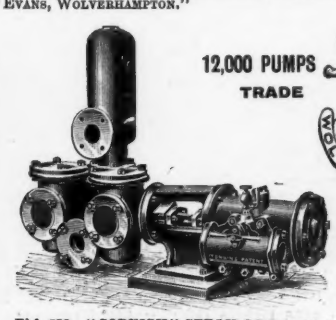

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

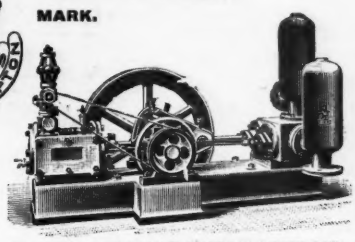

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

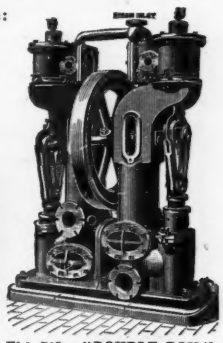

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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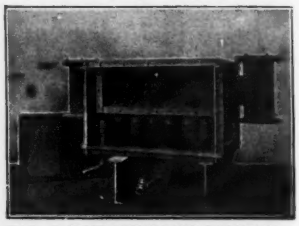

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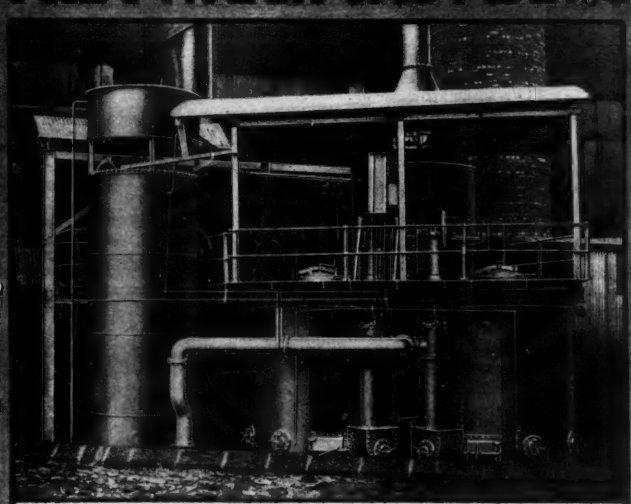

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Agram, Croatia	200,000	Flensburg, Sleswig	300,000	Poole	1,500,000
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Allenstein, Germany	200,000	Frankenthal, Germany	175,000	Portsmouth	1,000,000
Antwerp, Belgium	1,500,000	G. L. & C. Co. Beckton	2,250,000	Posen, Germany	450,000
Antwerp (2nd)	1,000,000	G. L. & C. Co., ,, (2nd)	10,750,000	Posen (2nd)	700,000
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Belfast (2nd)	4,500,000	Gelsenkirchen, Westphalia	175,000	Revel, Russia	350,000
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Berlin—Tegel (2nd)	6,350,000	Graudenz, Prussia	200,000	Rotterdam (3rd)	750,000
Bilston	375,000	Guildford	350,000	Rotterdam (4th)	750,000
Birmingham	1,500,000	Guildford (2nd)	200,000	Rotterdam (5th)	600,000
Bishop's Stortford	200,000	Haarlem, Holland	850,000	St. Albans	700,000
Bochum, Westphalia	630,000	Hamburg, Germany	1,750,000	St. Gallen, Switz.	225,000
Bognor	100,000	Hampton Court	500,000	St. Gallen (2nd)	225,000
Bordentown, N.J.	125,000	Hampton Court (2nd)	600,000	St. Joseph, Mo.	750,000
Bournemouth	1,000,000	Hartlepool	750,000	San Paulo, Brazil	700,000
Bournemouth (2nd)	500,000	Hebden Bridge	200,000	Santiago de Cuba	400,000
Bremen, Germany	550,000	Heidelberg, Germany	200,000	Scarborough	800,000
Bremen (2nd)	950,000	Holyoke, Mass.	600,000	Schwelm, Westphalia	100,000
Bremen (3rd)	850,000	Hong Kong	450,000	Shanghai	225,000
Brentford	1,200,000	Hull	1,500,000	Shanghai (2nd)	225,000
Brentford (2nd)	850,000	Ilford	650,000	Shanghai (3rd)	1,600,000
Bridgwater	200,000	Innsbruck, Austria	200,000	Southampton	800,000
Bridlington	150,000	Ipswich	750,000	Southampton (2nd)	500,000
Bridlington (2nd)	200,000	Kampen, Holland	350,000	Southampton (3rd)	600,000
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Brussels—Koekelberg	1,000,000	Lea Bridge (4th)	1,000,000	Stockholm (2nd)	1,750,000
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Brussels—St. Josse (3rd)	775,000	Leigh, Lancs.	350,000	Stockton-on-Tees	500,000
Brussels—Ville	750,000	Lemberg, Galicia	260,000	Swansea	750,000
Brussels—Ville (2nd)	750,000	Lemberg (2nd)	500,000	Swansea (2nd)	1,000,000
Brussels—Ville (3rd)	1,500,000	Liége, Belgium	1,000,000	Swansea (3rd)	450,000
Brussels—Ville (4th)	350,000	Liége (2nd)	750,000	Swindon	300,000
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Budapest, Hungary	50,000	Liverpool	3,500,000	Sydney—Harbour (2nd)	500,000
Budapest (2nd)	1,750,000	Liverpool (2nd)	4,500,000	Sydney—Mortlake	500,000
Carlisle	600,000	Liverpool (3rd)	750,000	Sydney—Mortlake (2nd)	500,000
Carlsruhe, Germany	500,000	Longton	600,000	Syracuse, N.Y.	850,000
Chigwell	350,000	Louvain, Belgium	800,000	Taunton	225,000
Chorley	300,000	Lübeck, Germany	400,000	Taunton (2nd)	350,000
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Commercial (2nd)	850,000	Magdeburg, Germany	1,400,000	The Hague (2nd)	500,000
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Copenhagen (2nd)	2,500,000	Malines, Belgium	500,000	Tottenham (2nd)	750,000
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Coventry (2nd)	600,000	Manchester	3,500,000	Tottenham (5th)	1,000,000
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Crefeld, Germany	500,000	Mayence, Germany	700,000	Utrecht, Holland	1,000,000
Croydon	1,250,000	McKeesport, Pa.	500,000	Utrecht (2nd)	1,000,000
Croydon (2nd)	625,000	Merthyr Tydfil	300,000	Verviers, Belgium	1,000,000
Croydon (3rd)	625,000	Middlesbrough	1,250,000	Vienna	3,500,000
Croydon (4th)	550,000	Namur, Belgium	175,000	Vienna (2nd)	2,500,000
Debreczin, Hungary	100,000	Nelson	400,000	Waltham	400,000
Deventer, Holland	150,000	Newburgh, N.Y.	600,000	Wandsworth & Putney	1,800,000
Deventer (2nd)	200,000	New York	5,200,000	Watford	300,000
Dorking	150,000	Nictheroy, Brazil	250,000	Watford (2nd)	350,000
Dublin	2,000,000	North Middlesex	150,000	Wellington, N.Z.	350,000
Dublin (2nd)	2,000,000	North Middlesex (2nd)	200,000	West Bromwich	550,000
Dublin (3rd)	650,000	North Middlesex (3rd)	75,000	West Ham	1,500,000
Dundee	1,500,000	Norwich	1,000,000	West Ham (2nd)	800,000
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Dunedin, N.Z. (2nd)	275,000	Norwich (3rd)	500,000	Weston (2nd)	350,000
Durham	200,000	Nottingham	1,000,000	Wexford, Ireland	100,000
Düsseldorf, Germany	1,000,000	Nottingham (2nd)	1,000,000	Wiesbaden, Germany	850,000
Eastbourne	1,250,000	Nuneaton	125,000	Winchester	225,000
Edinburgh	2,000,000	Oberhausen, Germany	175,000	Winchester (2nd)	125,000
Epsom	225,000	Oldenburg, Germany	200,000	Wolverhampton	1,500,000
Epsom (2nd)	300,000	Ostend, Belgium	100,000	Zwolle, Holland	200,000
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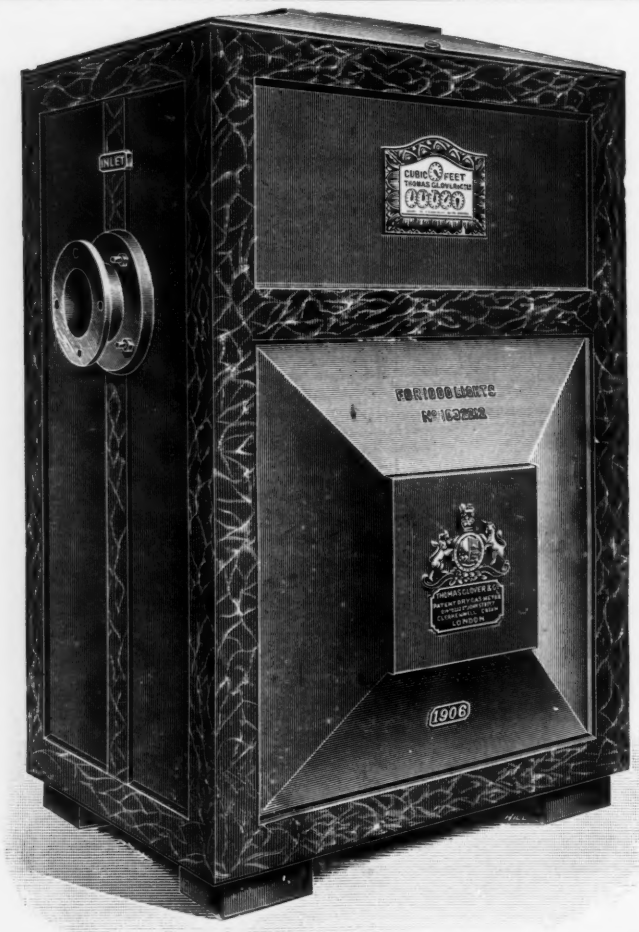

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VOL. CX., No. 2450.—TUESDAY, APRIL 26, 1910.

EDITORIAL NOTES—GAS, &c.

Humiliation and Resentment.

As expected, there was great weeping, wailing, and gnashing of teeth in the electrical press last week anent the Westminster street-lighting contract, which the Gaslight and Coke Company have secured, on a penalty-protected illumination basis. Never before have the Gaslight and Coke Company been painted as so arrantly foolish as on this occasion. They do not know their business; their electrical censors know it much better than they do. And if the Company do not listen to reason (as supplied electrically), the consequences will be somewhat tragic for the proprietors. Quite elaborate calculations are made (particularly by the "Electrician") to show that the Company are playing a losing game; and our friends—ungenerous in the hour of their vexation, and in that of the Gas Company's initial backsliding—withhold congratulation to the Company on the "tactics" they have adopted on this occasion. But unfortunately for all the caustic criticism of our contemporaries, they have based their figures and assumptions on ancient costs, and have taken no account of the subsequent advances of gas lighting. We need not therefore follow them through their wasted labours. The lighting will be on the high-pressure system with modern lamps, by which at least 60 candles per cubic foot of gas consumed per hour can be realized. As to the price of gas for public lighting, it is not the 2s. 8d. per 1000 cubic feet now charged by the Company for private lighting, but a lower figure controlled by Act of Parliament; and, under the new authority to the Company to supply gas of reduced grade in illuminating power, the maximum authorized charge for public lighting is down to a point that has never before been reached in the history of the concern. Moreover, it must not be forgotten that inverted, and not upright, burners will be used; nor that, by a single inverted burner and mantle under the high-pressure system, anything (according to burner used) from less than 100-candle power up to 1500-candle power can be obtained. From all of which the electrical critics will see that the bases of their calculations are in every respect vitiated. They have, in their calculations, ignored entirely all the conditions of modern gas progress. For their own credit sake, they ought to have been better posted, so as to have saved them from displaying their ignorance in such an extraordinary fashion. The "Electrician" thinks that the Company are supplying an article at 4d. per 1000 cubic feet which costs them 2s. to produce. In other places, 5½d. per 1000 cubic feet is mentioned. The figures and argument are humorous, not to say grotesque. Our contemporary should make itself acquainted with the real cost of gas into the holder, as well as the net cost. On the whole, the little spark of sympathy expressed in the words "we cannot help "feeling that the Gas Company has set itself too hard a "task," is misplaced.

We will not make too critical an examination of other points in the "Electrician" article, except a reference to show our readers how little our contemporary knows about the subject it ventures to expatiate upon with an unwarranted assurance. It is feared by it that the Gas Company will have considerable difficulty in obtaining and maintaining a unit of 3000-candle power. Then we read: "Even "with the most modern arrangements, they will probably have "to erect three lanterns on one post for the purpose; the "great amount of heat given out by large mantles making "it impossible to use more than a certain number of mantles "in one lantern." After such a revelation, the Gas Company surely ought to shuffle out of the contract in the most dignified manner possible, unless, of course, they happen to know that our contemporary is rather behind the times in its knowledge of gas-lighting matters. Following the cobweb of assumptions and figuring, there is a tirade in regard to the immorality of the Company in the matter of price-cutting. The writer must have had his tongue in his cheek when he started on this track. Even had our contemporary's computations not been based on unsound foundations and had been right, it should not be forgotten that the Company have, in this matter of public lighting, a very difficult fight against municipal traders with the purses of the ratepayers at hand to dip into. When there is talk of "tactics" in a vein that suggests the hopeless depravity of the Company, surely what they have had to meet in the way of "tactics" at Marylebone, Hampstead, and other places in connection with public lighting, must have already escaped memory. But we do not recollect that the "Electrician" withheld its congratulations to, for instance, Marylebone, when the Borough Council, at all capital and other costs, determined to oust the Gas Company from public lighting work in their area, nor that it trounced the Council heartily for what they did, though their action was twice condemned by the Finance Committee of the London County Council. From the published statistics, we see that Metropolitan electricity purveyors (municipal and company) practise price-cutting on public lighting to a degree never yet imitated in the gas industry. Several charge an average of 1d. per unit, and between that and 2d., for public lighting; while costs (ignoring capital expenses) amount to a higher figure. This sort of thing is winked at; but the Gas Company must not—we do not admit they are proposing to do this public lighting at a loss—use the same weapons as their competitors. What is right for electricity suppliers (according to electrical theory) is wrong for the Gas Company. Assuming, however, the Gas Company were not recovering total costs in this street lighting contract, what has that to do with anyone? They can certainly do what they please with their own money. It is not the same thing as playing with the ratepayers' money and interests.

The "Electrical Times" goes in for a little arithmetical exercise likewise in their attempt to prove that the Gas Company have undertaken the contract at a loss. But it does not indulge in the flights of imagination of the "Elec-"trician." The "Electrical Review," on the other hand, instead of expending powder and shot over the Gas Company, turns and rends the Electric Company for quoting figures so much in excess of the Gas Company, and figures that are higher than obtain at present in the area for street electric lighting. Perhaps the Electric Company are tired of public lighting at a non-paying price. We do not know; but the idea passes through the mind.

However, when a Borough Council ask for tenders for specified quantities of illumination or anything else, it is for them to accept the lowest offer, providing the tenderer is in a substantial position. In the interests of ratepayers, their duty is to get the best possible service at the lowest possible price; and in this case they have protected the ratepayers by heavy penalties for any violation of the contract. If this had merely been a contract improving present gas lighting by the adoption of a more efficient gas system, then less would have been heard of it in the electrical papers. But in the very heart of the West End, 71 electric arc lamps have to go. The humiliation is what has angered our contemporaries.

Mr. Balfour Browne on Municipal Trading.

WHEN Mr. Balfour Browne, K.C., D.L., unfettered by professional responsibility, speaks as he did in the lecture delivered yesterday week before the British Constitution Association, on the question of State and municipal trading, he scourges unsparingly an evil that is insidiously winding its way into our social system, and threatens to sap much of our individual vitality, to the degeneration of personal effort, responsibility, and character, and to the hurt of the country generally. No one can attack the breadth and the depth of the experience from which the argument and

submissions of Mr. Balfour Browne are deduced. His experience may almost be described as unique; and it has not been obtained from any one-sided or contracted view, but has been built up from exceptional opportunities for investigating the effects, actual and potential, of private enterprise as compared with municipal adventure, with which personal effort and responsibility have no particular ties. Mr. Balfour Browne is firm for individualism and private enterprise as opposed to collectivism. The former is a greater effective force than the latter; and the pity of it is that while the latter is less effective, those who acclaim and foster it are the prime-movers in placing (as the lecturer expressively describes the obstructionist process) spokes in the wheels of progress. Municipal trading can, by no stretch of the imagination, lay claim to initiative in enterprise. The municipalizers are usurpers pure and simple. In relation to gas affairs, municipal authorities have put many "spokes" in the wheels of progress; but the curious thing is that directly they become owners of that which was formerly privately owned, they are very prompt in securing the removal of the obstacles that they themselves were instrumental in placing in the wheels of their predecessors. It is a singular thing, too, that so long as private ownership prevails, the local authority are absolutely blind to progress that changes fundamental conditions. They persist in archaic enactment when the incandescent burner, the gas-engine, the gas-cooker, the gas-fire, the industrial furnace, the tool heater, and the crucible, have rendered ineffectual a requirement that ought, from economic, scientific, and practical points of view, no longer to exist. In all these things, science and individual effort might just as well have stood still for all the aid our non-gas-works owning municipal governors have accorded to the spread of the material advantage yielded by scientific progress. One thing that can be said for the municipal ownership of gas undertakings is that such owners, in these latter years, when change has been so rife in the gas industry, have not done anything to prevent the full benefit of the change being reaped by the section of the gas industry represented by private enterprise. On the other hand, we do not see, by example, that municipal owners of gas undertakings have done anything to assist municipal authorities who are not gas-works owners to see the errors of their repressive and oppressive ways. They may take this as a suggestion of means by which the common interests of the gas industry may be furthered by their intervention.

One thing is very desirable; and it is that the law relating to the trading branch of municipal activity should be thoroughly revised in the light of experience. Fundamentally, the general legislation governing municipal trading remains much what it was at the advent of parliamentary sanction to local authorities stepping outside their legitimate sphere. And it is the old tale—for every inch of privilege then allowed, a full ell has since been taken. As in most cases in parallel, we do not believe that it was ever anticipated that what was done at the beginning would have supplied such fertile ground for the growth of the doctrines of Socialism, and would yield such a crop of evil as has been witnessed. Therefore, there is complete agreement with Mr. Balfour Browne that some further consideration of our present position in relation to State and municipal trading might be useful. But there have been inquiries, and condemnation has followed. There, however, the matter seems to have a consistent ending. It signifies not which political party is in power, it appears to be nobody's business to put the needful stop to these blighting influences. Directly there is the slightest indication of greater control by Parliament or by some Central Government Department, the municipal traders squeal out as if suffering fearful pain. Only the other day, Mr. Harmood Banner, M.P., in his presidential address to the Association of Municipal Corporations, deplored the increasing desire on the part of Government departments to obtain more or less absolute control over local authorities; and he described it as one of the greatest dangers threatening municipal life at the present time. We find it far easier to appreciate the necessity for this control than to see the great danger. The necessity for greater control, for a better definition of powers, and for a larger degree of restriction, is the product of excesses, and of an unreasonable interpretation of the powers already possessed. For this reason, in addition to the fact that the policy of profit appropriation in aid of the rates is repugnant to our ideas of the true purpose of civic direction of trading concerns (to which system, it is hardly requisite to say, we are altogether opposed), it is gratifying to see that Parliament is setting-out—as instanced by Salford, Oldham, and Glasgow—to produce reform in this respect. "The policy "of 'use,'" says Mr. Balfour Browne, "as contrasted with "'profit,' is going to have its way." It is the only justification for municipal trading. But it cannot be admitted that, when municipal undertakings are worked for the service of the community, as distinct from profit-making, the element of profit is altogether absent; for the money required for interest and sinking fund in respect of the capital invested has to be earned by the business. Real advantage from State and municipal trading is all a myth; and the lecturer shows, with that clear perception and vigorous diction of his, that, far from advantage accruing, the system supplies the ground for much noxious growth.

Eighteen Vertical Retorts in One Setting.

The publication in last week's issue of the lecture by Dr. Geipert, of Berlin, on the Dessau settings of eighteen vertical retorts will not fail to have attracted the attention of all who are keeping abreast of the advances in practice of those who have taken upon themselves the work of developing the vertical retort processes. In the forefront of the lecture, we are shown that the most profitable part of all gas-manufacturing operations that the gas manager can explore in the search for economy, is that of carbonization. The first thing to be done is to make a judicious selection of retort-setting; and the next is to work the setting in the most rational manner. In both respects, the gas manager is faced by an extent of discretionary scope that is at times rather perplexing. In respect of choice, Dr. Geipert says our forefathers were better off, because they had none, and so were not worried by philosophical considerations as to relative pretensions, and as to future operation and result. If, however, our forefathers were with us to-day, and viewed their position from the standpoint of the enhanced result of the present times, we doubt whether they would subscribe to the suggestion that, in their circumscribed state in the matter of choice, they were better off than their successors. But, of course, Dr. Geipert has no desire to have the passing remark taken too literally; for he proceeds to welcome the tremendous progress that has been made in the art of gas manufacture by the development of more efficient carbonizing plant, which has resulted per unit of output in economy of labour, fuel, and expenditure, and in increased product from the raw material. It is the latest form of the Dessau vertical retort-setting that Dr. Geipert naturally regards as pre-eminent among the rivals. In this setting, eighteen retorts are nested in the space formerly occupied by twelve; and the presentation of the results derived from the change is the primary object of the lecture.

We had been led by prior information to look upon the new setting of eighteen retorts as marking a distinct advance in the matter of the balance of advantage as compared with its immediate precursor; and there is now the substantiation. One important feature of the new design of setting is based upon an idea borrowed from the designers of carbonizing chambers, in that there is an increase in the ratio of the retort heating surface to the quantity of coal carbonized. This is one direction in which the experimenters with the Dessau system are now not only confident, but satisfied that there is realizable economy. The retorts are described as being "specially narrow, so that the heating surface is "relatively very large." It is not observed that mention is made of the point in any part of the lecture; but it would be interesting to know whether this narrowing of the retorts has any effect upon the quality, or, perhaps we should say, the density, of the coke. Apart from this, in other respects the duty of the setting—not the duty per retort—is augmented by the change in design. The four points on which it is found that the new setting greatly excels the old in economy, are in increased make per setting on the same ground space, in the considerable reduction of fuel in relation to the coal carbonized, in respect of the cost of installation, and in wages per unit of production. These points require no elaboration to emphasize their importance; and, as between the old and the new types of Dessau setting, they mark a distinct economic advance. In one set of results cited in the lecture, it is remarked that the make of gas on the same ground space, or in an eighteen-retort setting of like over-all dimensions to a twelve-retort setting, was increased by no less than 38 per cent. The make per ton was approximately the same, as was also the gross calorific power.

The coke used as fuel was very considerably reduced—by as much as 3·2 (15·0 to 11·8) per cent. by weight of coal carbonized, or to only 19·2 lbs. per 1000 cubic feet of gas made, which low figure compares with 28·7 lbs. in the case of the Munich carbonizing chambers. We could have wished that Dr. Geipert had supplemented his figures by stating the illuminating power of the gas, as though Germany in many places can ignore this quality, we cannot afford to do so while the British gas industry is under the domination in that regard of statutory standards and penal testings. This omission apart, the conversion of the twelve-retort Dessau setting to one containing eighteen retorts has been completely vindicated by the excellence quantatively of product and other working results.

In the concluding part of the lecture, Dr. Geipert replies to some of the points raised by Mr. A. T. Harris in the paper which he read at the recent meeting of the Midland Association of Gas Managers.

Radiation.

When we realize that our most efficient systems of lighting are still inefficient, and that our methods of heating still leave much to be desired, then it will be recognized that all serious discussion and work on the various aspects of thermal and luminous radiation, with special reference to the uses of town gas, must be valuable both in instruction and in suggestiveness. It must be confessed that, although the fortunes of the gas industry are founded so largely on thermal and luminous radiation efficiencies, there has been a lamentable lack of relevant knowledge in the industry's general technical ranks. And the industry's technical ranks are not above acknowledging the truth of the impeachment. For this among other reasons, we welcome the paper on the subject that Mr. J. G. Clark read at the meeting of the London and Southern Junior Gas Association last Friday. It may be that he soared somewhat above the heads of some of his hearers; but for such a body—in fact, for any technical body—there is little use in keeping down to the highest level of the present knowledge of members, and never going beyond. For by doing so, the work would get into a stereotyped condition, or into a rut; and the members would never make any real advance in the knowledge they are organized expressly to accumulate and assimilate. But touching the paper. Without a proper understanding of basic principles—among them the theory of radiation—there can be very little practical advance made in the economy and efficiency of the appliances of the gas industry in which temperature is a power of primary importance. In the gas industry, we have in the last few years had the truth of this enforced in a very practical manner by positive successes. Appliances have in the past been subjected to too much speculative design; but now, in every direction of gas utilization, the spread of scientific knowledge and rule is making material impression on the intrinsic values of productions that are offered for use—to the advantage of both user and industry.

Among members of Junior Associations are those who require to have their knowledge of principles expanded so as to stimulate them to seek, and assist them in seeking, to produce progress on correct scientific lines. But it is essential that what are called "correct scientific lines" do not belie the description. There are words in the paper that suggest to us the necessity of impressing upon the juniors the importance of investigation work aimed at achieving advancement being governed by really accurate scientific method, in order to get a proper start. Many improper conclusions are derived through inexact and inconclusive scientific method; and many a worker has been misdirected through this, and has thus wasted much precious time and labour. There is nothing wrong about this statement; it only serves to remind of a case in point: "Comparing the "radiation from the argand flame, and that from an incan- "descent gas-burner, the proportion of thermal to luminous "radiation is found to be larger in the former case than in "the latter." But what that proportion is may be considerably varied by the method by which the tests are carried out to determine it. For instance, in papers published in 1902-3 on the theory of the incandescent mantle, careful as the experimenters believed themselves to be in conducting the research on which the papers were founded, Professsor Vivian B. Lewes detected weaknesses which went to corrupt the results that were published. For example, in taking mantle temperatures, the experimenters employed a burner intended for use with a chimney; but the chimney was discarded by them on the ground that it interfered with the manipulation of the thermo-couple. This did away with the draught round the mantle; and instead of the flame burning as it should on the surface of the mantle, it had its outer zone of combustion thrown outside the mantle. That this is so (remarked Professor Lewes in his criticism) is shown by a Welsbach mantle only giving 15·7 candles per cubic foot of gas, instead of 19, as it would probably have done with a chimney on. Under these faulty conditions, the experimenters took the temperatures of the mantle and the hottest part of the flame outside it; and they found the flame considerably hotter than the mantle.

Mr. Clark's paper is not one giving room for criticism; and in the main, for our purposes, it merely offers points that may be emphasized. One point that should be particularly noted by those investigating temperature and radiation problems with the view to practical application is this: "We find in practical work that we cannot produce luminous "effect without accompanying thermal effect; and we can- "not produce any great thermal effect without accompanying "luminous effect. What is possible, however"—this is the important point—"is to vary the proportion of the luminous "and thermal effects, so that the required effect is made the "more prominent." Then we go on to see the results of observations made simultaneously with a photometer and a thermopile directed to an incandescent mantle fitted upon a burner. The observations were made at various gas pressures; and, as one would expect, both the luminous and the thermal effects were found to increase with the pressure —the former advancing more rapidly than the latter. The cause of this, of course, is the higher flame temperature produced at the higher pressures. This is precisely what Mr. A. W. Onslow has found in regard to the thermal efficiencies of industrial furnaces heated by high-pressure gas. Not only, as he was telling the Society of Chemical Industry recently, does he get, by using high-pressure gas, greater heating effects, with more uniformity throughout the furnace, but they are more constant, and are reproducible at will. The value of the use of reflectors in connection with lights is a point that was also demonstrated by Mr. Clark in the paper; but it is an essential condition that they must be properly designed for the particular work that the lamp concerned has to do. Reflectors are made and applied at the present time in much too haphazard a way; and the sooner manufacturers realize this the better. With the advance of the system of purchasing for street-lighting purposes specified illumination, photometrically tested at defined angles and distances, this question of the proper scientific design of reflectors will become a highly important one.

Dealing with the subject of thermal radiation, we find that Mr. Clark has only a qualified appreciation of the thermopile —finding it useful for certain purposes on account of its handiness and low thermal capacity, but quite unsuitable for the commercial evaluation of gas-fires. In view of this, he has designed a form of radiation calorimeter, which he believes to possess novel features. If Mr. Clark has succeeded in producing a dependable, or even an approximately correct, radiation calorimeter, he will deserve the cordial thanks of all gas managers who are wanting some readily applied means of making comparative testings of the radiation values of the gas-fires that are brought before them by the makers. Reading the description of the new radiation calorimeter, it appears to be right in principle; and certainly from the point of view of simplicity, it is to be recommended. But beyond this, it is too early to go in speaking of the arrangement *pro et con*. It will be observed from one of the diagrams, that there is no positive relation between the values obtained by the calorimeter and those obtained by the use of the thermopile—this, as explained by Mr. Clark, being due to the fact that the thermopile intercepts a much smaller quantity of the radiation than the calorimeter. But Mr. Clark has struck out into a new line in radiation valuation; and we hope that, from an attitude of interest, there may soon be a change to complete conviction as to the practicability and usefulness of the invention, which supplies, in our opinion, the central feature of a paper that has been most carefully prepared, and bears even indication of extended study and research.

Gas Exhibit at the Japan-British Exhibition.

The special attention of readers is asked to the communication that it is our pleasure to publish in the "Correspondence" columns this week from Mr. D. Milne Watson, the Chairman, and

Mr. F. W. Goodenough, the Hon. Secretary and Treasurer, to the Gas Companies' Joint Exhibit Committee in connection with the Japan-British Exhibition. This Committee has been constituted from the chief officials of London and Southern Gas Companies who, being in close, or comparatively close, touch with the Metropolis, can render personal, and thus effective, aid by their counsel in furthering the work of organizing an exhibit (see "JOURNAL," Feb. 22, p. 487). It will be seen by the letter from the Chairman and the Hon. Secretary and Treasurer that the plans and work are well advanced; and that now all that the Committee are anxious to secure is a fairly large guarantee fund. Twenty-three gas undertakings in London and the suburbs have already guaranteed £2285; but the Committee would be glad to have at least £3000 at their disposal. The bulkier the guarantee fund, the better; for the Committee would like to feel that their liberty was not restricted for the sake of a little extra money, and at the same time they would prefer that the guarantee fund should be of such an amount that there would be no necessity to call upon the individual guarantors for the full amount of their guarantees. The constitution of the Committee is a sufficient surety that the money will be expended wisely and well in demonstrating to the large and representative public that will be drawn from all quarters of the country, some of the most modern improvements in the application of gas. There is no doubt the Shepherd's Bush Exhibition this year is going to be a highly popular one; and our "allies" of the Far East are doing their best to make it so. Therefore, on all grounds, we have pleasure in supplementing the appeal of Mr. Watson and Mr. Goodenough for an immediate generous consideration and decision, on the part of Boards of Directors and Committees, regarding the question of entering the names of their undertakings on the list of guarantors, with the amount of the sum for which there is willingness to be responsible, in respect of the expenditure that will be incurred over this excellent project.

The Gas Fight at Warsop.

The Warsop Urban District Council evince keen disappointment at the refusal of the Local Government Board to sanction a Provisional Order which would have enabled them to manufacture and supply gas. The disappointment will not, however, be anything like universal among the ratepayers; for keen opposition from influential quarters was shown to the scheme at the time of the holding of the local inquiry into the application—a lengthy report of the proceedings at which will be found in another part of this issue. And not only have the Local Government Board declined to give their sanction to the Order, but apparently efforts made to induce the President of the Board to receive a deputation from the Council to discuss the matter have likewise proved unsuccessful; for we learn from a local paper that "all influence possible has been brought to bear upon Mr. John Burns in order to persuade him to receive a deputation, but the efforts of Mr. Markham and Mr. Hume-Williams in this direction have proved futile." It is unnecessary to go into the details of the question here, for they are clearly set forth in the statements of Counsel and the evidence of the witnesses who were called at the inquiry. But it may be remarked that a strong point was made by the several large ratepayers who opposed the scheme of the fact that there is already a Gas Company (who also strongly opposed the granting of the Order) supplying a portion of the parish, who are willing to take over the remainder. This is the Shirebrook and District Gas Company, from whose mains, it was argued, prospective consumers would be able to get a cheaper supply of gas than they were likely to obtain if the Council's proposals were carried out. At the subsequent ratepayers' meeting, a member of the Council who gave evidence at the inquiry in favour of the application for the Provisional Order, said that "for some reason it was thought by the Local Government Board best for the Council not to have control of the gas supply. It appeared they believed the Shirebrook Gas Company could bring gas much cheaper than the Council could supply it." This is how the decision strikes a supporter of the Council's case; and there is no sufficient ground to accuse him of having gone astray in his reasoning. In all likelihood the question of probable price was taken into consideration by the Board; but as in giving their refusal they said that, looking at all the circumstances, they had come to the conclusion that they ought not to grant the Order, it is only fair to assume that there were also other matters which influenced them. Having thus failed in their attempt to provide a gas supply under their own control, the Council have now been authorized by the ratepayers to take steps to secure the best protective clauses possible in the Shirebrook Company's Bill.

Gas Consumers and the Standard Burner Bill.

An article with the capital heading "The Standard Burner Bill," and with the sub-titles "What it Means," and "The Consumers' Point of View," has appeared in the "Liverpool Courier." The article does not tell with truth what the burner really means; and what it does say is not from the consumers' point of view, but is obviously written by a technical antagonist in a specious way for the express purpose of creating some alarm among gas consumers, or an agitation for some *quid pro quo*. There is an insinuation that the promoters of the Bill are, by their proposal, doing something craftily, and doing it secretly, with the object of deceiving consumers. The Bill, we read, is one "for reducing the illuminating power of the gas supplied in several areas named in the schedule, without the knowledge and consent of the consumers." If all the asserted evils that accompany the use of the burner were real and not phantoms, the consumers would soon be made aware of what had been done; and there would before this have been a terrible outcry in those eighty or so gas-supply districts where the burner has already been applied. The readers of the article are told that "a depreciation in candle (or lighting) power, estimated at from 10 to 20 per cent., will certainly follow in all towns and districts served by the companies named in the schedule of the Bill." There is nothing like having a good impressive margin; and the 10 to 20 per cent. gives it. But the shocking degradation of illuminating power predicted only refers to that small portion of the gas used in flat-flame burners; and it must surely have been a slip of the pen when "A Correspondent" wrote what is tantamount to a warning to consumers not to use gas at all for its own illuminating power. He says: "The old batswing burner, with its flat flames exposed to the cold air on both sides, is now generally admitted to be a most defective burner." So what is the use of having a gas of high illuminating power merely for consuming by the aid of what are admitted to be defective appliances? The logic of the writer in the "Liverpool Courier" is as defective as the flat-flame burner. The consumers, too, who are foolish enough to continue to use flat flames will "dread" a further reduction of 2 to 4 candles in the illuminating power of the old, defective batswing burner. Why "dread" it, when the incandescent gas-burner offers nearly a tenfold increase of illuminating power for a given consumption of gas? Why suffer any torture when cheap relief is at hand? The article has a close alliance with the ineffectual bogeys recently raised in the Parliamentary Committee rooms.

What is Wanted.

The writer, however, is good enough to express the opinion that it is useless to expect that the opposition to the present Bill will prevent the adoption of the improved burner for testing purposes. The real intention of the writer's labours, however, is found in the concluding lines of the article. He says: "The change ought to be accompanied by a *quid pro quo* to the public either in the shape of a reduction in the price of gas, or in the acceptance by the gas companies of maximum and minimum calorific tests for the quality of gas supplied. What consumers can do in the present case is to insist, through their representatives in the Council and in Parliament, that a clause defining the nature and character of these concessions to the public shall be inserted in the Bill before it passes the House of Commons Committee, and receives the Royal Assent. It is to be hoped, therefore, that the various corporations and local authorities who are opposing the Bill will leave no stone unturned to obtain the addition of the proposed clause to it." It is not mentioned in the article that the local authorities left no stone unturned in the House of Lords; and a pretty mess they made of the whole business, as was shown by Mr. Honoratus Lloyd, K.C., whose view was endorsed by Lord Ritchie and his colleagues.

In the "JOURNAL" for the 22nd of March (p. 811), we described and illustrated a mounted cubic foot bottle which had been brought under the notice of the members of the New York Section of the Society of Chemical Industry. We learn that this was done by Dr. E. G. Love, the Gas Examiner for New York, and not by Mr. E. C. Uhlig, as stated.

NOTES FROM WESTMINSTER.

From the extraordinary interest distinguishing the Committee work of the preceding week, we have been precipitated into a period of comparative dulness. Gas matters have been confined to a few measures before the Unopposed Bills Committee, and to the small gas section of the Bradford Corporation Bill. For the rest it has been all water and railway affairs. As to progress, the most interesting point is that the Standard Burner Bills have finished their course through the House of Lords, and have been transferred to the Commons, where it is hoped they will receive just as wise treatment as in the Upper House. There will be a little repose for them, and for those who are actively hostile to them, and those who are prepared in their defence, inasmuch as there is close at hand the long-promised holiday for our legislators which will take us well into May. It will be an unkind thing if it should happen that the Bill reaches the Committee stage in Institution week.

A Long-Standing Agreement.

In pursuance of their policy of becoming the sole purveyors of gas within their administrative limits, the Bradford Corporation have had for the past three years among their schemes one for the purchase, under an agreement entered into in 1907, of the private gas-works in the city owned by the Trustees of Sir Henry W. Ripley, who supplied gas to an area in its entirety part of the Ripley estate. The matter of getting the sanction of Parliament to the purchase, and of giving effect to the agreement, has been previously incorporated in a Bill, which, for other reasons, the ratepayers rejected; and this deferment raised the question in the minds of the Local Government Board, on the Bill of this session coming before them, as to whether the works may not have depreciated in value since the agreement was signed and sealed. The query supplied a point for discussion when the gas section of the Bill was before the Local Legislation Committee the other day; but Mr. Charles Wood had no difficulty in assuring the members that the Corporation, for the £15,000 they are going to pay, will get full value for their money. The section proceeds; so that the Corporation are now fairly on the way to the execution of this long-standing agreement.

Unopposed.

The Unopposed Bills that were before Mr. Emmott's Committee during last week, included the Bishop's Stortford, Farnham, Exmouth, and Egremont gas measures. The point that seemed to agitate the Committee most about these Bills was in the first two, and had reference to the proposed electricity supply powers. There is ample precedent for conferring such powers upon gas companies; and the Committee have not departed from the precedent. In the case of Bishop's Stortford, there are still in existence electricity supply powers, originally secured by the Council, and transferred by them to a Company, but still unexercised; and the Gas Company have pledged themselves not to exercise the powers that may be conferred upon them until the Board of Trade revoke those still existing. The Unopposed Bills Committee are anxious to have before them the views of the new Council on this question of electricity supply before granting the powers to the new Gas Company, constituted by the Bishop's Stortford, Harlow, Epping, and other Companies. The preamble of the Bill has been passed; but this one matter of electricity supply stands over for the present. There is, however, every prospect of the electricity part of the scheme going through, seeing that Mr. Cooper, one of the members of the Council, says he knows of nine members out of fifteen who are in favour of the Gas Company supplying electricity. One thing the Council have to consider is whether the Company can, through their special facilities, supply cheaper than an independent electricity concern. If the Council do so consider, then their duty is clear. The application for electricity supply powers was also the subject of a little discussion in connection with the Farnham Bill; but nothing came of it beyond evoking information. The preamble of the Bill was passed. The Exmouth Gas Bill also went through, with the Mountain Ash stand-by clause in it. The Egremont Gas Purchase Bill likewise met with the approval of the Committee.

Water.

As remarked in the opening paragraph, the week has been notable for the consideration of water measures. The principal Committee was the joint one of the two Houses on the Water Supplies Protection Bill, who commenced their sittings last Wednesday, and had a most interesting lecture from Mr. J. Lithiby, the Legal Adviser to the Local Government Board, on various matters pertinent to the measure. We were taken back to the ancient law of Rome as laid down by Justinian, and had the well-known information repeated as to the law of underground water supplies. The powers of the Local Government Board were traced; and then the clauses of the Bill were examined and criticized—sometimes not altogether favourably. It may, for instance, be a very good general sort of rule (as laid down in clause 5 of the Bill) that, when an authority goes a distance for a water scheme, it should supply not only the county district from which the water is drawn, but if required the towns and villages through which the pipe-line conveying the water passes. But such a rule may be, in extreme cases, absolutely absurd. We know what has been done in connection with some other important places; but imagine the rule being applied (say) to a pipe-line bringing water to London from Wales. London might fare badly. The information laid before the Committee by Mr. Lithiby has been followed by a good rest on the part of the members; but it is expected that they will soon be heard of again.

The South Hants Water Bill has been the subject of a big discussion before Mr. Armitage's Committee in the Commons. The Bill, as our notice on Feb. 22 (p. 494) showed, is mainly for empowering the construction of new works and for capital powers. Numerous technical and local witnesses were called before the Committee in support of the measure, and to back the opposition of the Corporation of Southampton. The most important news connected with the fight has been that the preamble of the Bill has been approved; but certain clauses have been modified. The Committee thought that the basis of the water-rate should be assessable value, and that there should be a new scheme arrived at on that basis. The capital, it was decided, should be reduced to £60,000, with borrowing powers of one-fourth. The rest of the Bill was passed; but the Committee, realizing that the Company and the Corporation draw from the same source of supply, considered that, in the general interests of the community, the water supply should be under the control of one authority. They did not, however, express an opinion as to the composition of the authority. The last-named matter is one for the future. The Corporation were not represented on clauses, so they will no doubt put in an appearance in the Upper House.

Among miscellaneous matters, the Mountain Ash new reservoir scheme has been before the Local Legislation Committee. The reservoir, it is proposed, shall have a storage capacity of 120 million gallons; and it is estimated that it will cost £74,765. The Bill is to proceed; but the Committee decided that the District Council should make full compensation for all expense reasonably incurred through the bursting of the reservoir at any time. The Exmouth Water Bill has been before the Unopposed Bills Committee; and the preamble has been declared proved. The Aberdeen Corporation new water scheme has been under the consideration of a Committee of the House of Lords; but the time since consideration commenced has been protracted owing to the unfortunate illness of the Chairman, Lord Gorell. Earl Camperdown has taken his place; and the conclusion of the hearing of the evidence is now at hand.

Personal.

Mr. J. F. West, the Manager of the Stamford Gas-Works, has resigned, and Mr. H. Green, the Secretary, has been appointed Manager as well. Mr. Green was trained under his father, the late Mr. Charles Green, at the Market Rasen Gas-Works, was afterwards an assistant to Mr. R. G. Shadbolt at Grantham, and six years ago became Secretary to the Stamford Gas Company. He holds a first-class certificate in the ordinary grade in "Gas Manufacture."

Obituary.

The death occurred last Tuesday, in his eightieth year, of Sir Samuel Black, who filled the positions of Town Solicitor and Town Clerk of Belfast from 1871 till March last year, when he retired. A few years after his official connection with the Corporation, the purchase of the undertaking of the Belfast Gas Company, of which he cordially approved, was effected.

Annual Meeting of the Italian Gas Association.—We learn that, under the presidency of Sig. Ing. Luigi Chavannes, the thirty-ninth annual meeting of Italian gas and water engineers will be held in Naples on the 6th of June and two following days.

Southern District Association of Gas Engineers and Managers.—The spring meeting of the Association will be held, on the invitation of the Directors of the Bath Gas Company, and the President (Mr. C. Stafford Ellery, the Engineer and Manager of the Company), at Bath on the 12th prox. An interesting programme has been drawn up; and arrangements are being made for a saloon carriage from Paddington for the London members. During the day, a short business meeting will be held for the purpose of filling the office of Hon. Secretary and Treasurer, which has been rendered vacant by the retirement of Mr. James Paterson.

Eastern Counties Gas Managers' Association.—As briefly announced in the "Journal" last week, the half-yearly general meeting of the Association will be held at Great Yarmouth on Friday; the business being transacted at the Royal Assembly Rooms, under the presidency of Mr. John Young. According to the programme issued by the Hon. Secretary and Treasurer (Mr. T. A. Guyatt, of Ely), the report and accounts for the past year will be submitted, two new ordinary members and one associate member will be proposed for election, and discussions will be opened on "Purification" and "Free Maintenance," by Mr. F. Prentice and Mr. F. L. Wimhurst respectively. Subsequently, the officers for the ensuing twelve months will be elected, and the place of next meeting fixed upon. The members will be entertained at luncheon by the Chairmen and Directors of the Great Yarmouth and the Gorleston and Southtown Gas Companies; and in the evening they will dine together at the place of meeting. On Saturday, they will visit the Great Yarmouth Water-Works, and be entertained at luncheon by the Chairman and Directors of the Water Company.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 266.)

All markets on the Stock Exchange were completely dominated last week by the power of the great speculative centres. The size to which this had grown, the enormous amount of money involved, and its potentialities for mischief gave it an influence that could not be avoided or disregarded. Consequently, the check it sustained last week was felt everywhere to some extent. The first sign of a change came on the opening day, when Rubber fell. The leading departments remained quiet, but were inclined to give way. There was some fair buying of gilt-edged issues; but Rails were less supported. Tuesday was under the influence of the fall in the big speculation, and exhibited dullness to a degree, though the close was better than the worst of the day. Consols fell ⅛. On Wednesday, the weakness in the speculative market dominated all departments. The gilt-edged class moved irregularly, Rails drooped for lack of support, and American and South African were weak. Thursday opened uneasy, in view of the pressure to sell in the Rubber Market, and the leading departments kept very quiet. But when the atmosphere had cleared somewhat, a little recovery set in here and there, but not uniformly. Friday was better; the improving state of things in the speculative lines relieving the apprehension, and the general attitude of the leading markets being steady. Saturday was a quiet day, and devoid of exciting features; and no particular change was observable. In the Money Market, the earlier tendency was in favour of easier conditions; but later on the market hardened and closed very firm. Business in the Gas Market was pretty brisk (some issues coming in for a good deal of attention); but movements were irregular. A few quotations were put back to a slight extent, although it would be hard to say why. On the other hand, there were quite as many that were put up. In Gaslight and Coke issues, the ordinary was brisk and busy, and prices realized were every bit as good as those the week before —viz., 103¾ to 104⅝; but the quotation was lowered ¼. In the secured issues, the maximum was done at 89½, the preference at from 104½ to 105⅝, and the debenture at from 81¼ to 82¾. South Metropolitan was rather quiet but very steady at from 121¼ to 122. The debenture marked from 81¼ to 82½. Nothing was done in Commercials, except one deal at 104 in the 3½ per cent. Among the Suburban and Provincial group, Alliance and Dublin realized 83¼ and 84½ (a fall of 2), Brentford old 251 special, British from 44 to 44¼, Bromley "A" 117½ (a rise of 2), North Middlesex 13⅜, South Suburban preference 122½, and ditto debenture 123½. On the local Exchange, Tynemouth was done at 114 (a rise of 1). In the Continental companies, Imperial was a good deal more active, and was firm at figures which ranged between 181½ and 183, while ditto debenture marked 95½. European fully-paid marked from 24½ to 24⅝, and ditto part paid 18½, both issues being put down ½. Malta was done at 4 1/16. Among the undertakings of the remoter world, Bombay changed hands at 6½ and 6 7/16, Oriental at 142½ and 143, Primitiva at from 7⅛ to 7 1/16, ditto preference at from 5⅞ to 5 7/32 (a fall of 1/16), ditto debenture at 99½ and 99¾, and San Paulo preference 12.

ELECTRICITY SUPPLY MEMORANDA.

Profits and the Rates—Distinction between Gas and Electricity Undertakings—Apathy or Parsimony?—Ignoring Tendering Conditions—Eternal Life—Information Wanted.

The decision of the House of Commons Committee in connection with the Glasgow Corporation Consolidation Gas Bill, depriving the Corporation of all right to appropriate money in relief of the rates, has come as a heavy blow to those city and town councillors who look upon such trading undertakings as a source of revenue for the municipal treasury. They found it bad enough when Parliament last session, in both Houses, pronounced, in the cases of Salford and Oldham, in favour of the limitation of profit transference to the common funds of towns; but this Glasgow decision is, indeed, practically unbearable. It will no doubt be said, by those looking for some consoling point, that the decision after all only removes the Glasgow Corporation from the (practically unexercised) powers that they possessed under their Private Acts to the general Scotch law, under which surplus gas profits have compulsorily to be applied not to the relief of ratepayers, but to the relief of the gas consumers, who provide the money to meet capital interest and sinking fund, the rates levied on the undertaking, and the expenses of maintenance, working, and administration generally. The principle is a correct onet. It is to be feared that Parliament itself is largely responsible for a time-honoured and unrighteous fostering of the rule of profit transfer to the municipal treasury by the perpetuation, in municipal financial enactment, of the right to transfer (if thought proper) the residue of gas profits to the district funds. This condition dates back to a time when there was some doubt as to the financial results of municipal trading; and it would be a very good condition if it were limited to the repayment of all (and nothing beyond) expense incurred by the local funds on behalf of the undertaking concerned. But in regard to municipal gas undertakings, the concern that has become indebted to the local funds in any way is an exception rather than a rule. It is not the same with electricity undertakings. Though thirty years have passed since the advent of general electricity distribution, there are not a few municipal electric undertakings that are a burden on the common funds. In such cases, we would make the full discharge of the obligation to represent the boundary-line to profit transfer. The ratepayers, *quâ* ratepayers, have in equity no right to anything more.

The matter has become of considerable moment in these days, when many municipalities are running both gas and electricity concerns; and the gas undertakings are being made to bear a disproportionate part of the contributions to rate alleviation. It is not a general experience that a municipal electricity undertaking can afford to contribute anything towards the general rates; and when one can so afford, the contribution invariably looks trifling in contrast with that from the gas undertaking. In many cases, the boot, too, is on the other leg—the electricity undertaking begging for assistance and relief from the district funds. But there are electricity undertakings that do contribute what may be termed substantial sums in aid of the rates; and some of the committees in charge of the concerns prate boastfully of what they are doing in helping to ameliorate the conditions of the ratepayers. There are other committees who do not like making contribution, and are of opinion that the true guiding principle of municipal trade enterprise should be the best service to the community at the lowest cost. That is the principle for which we have been fighting practically from the dawn of gas-works transfer from private to municipal ownership. And now that the contest is so keen between gas and electricity, some local electric supply departments are anxious to have every penny of profit residue to assist them in bringing down the prices of current. But they cannot very well contend for this without recognizing that what is not good for them is not good for the gas department; and it has also to be recognized by them that their own release from contribution will mean, generally speaking, the release of larger sums now monopolized in aid of the rates to the benefit of reductions of gas prices. This will be a highly desirable condition from the gas suppliers' standpoint.

There cannot, however, be any difference in the policy in this respect applied to the two classes of undertaking. Gas consumers cannot, or ought not to, be the victims of shameless municipal pilferers, while electricity consumers go scot free. There must be equality; and therefore electricity departments should join hands with gas departments opposed to profit appropriation for rate relief to put an end to the practice, if not to get the law altered. The votes of two such important committees should count for much in a municipal council. We see no reason why, for instance, the Electricity Committee of the Manchester Corporation should not unite with the Gas Committee in endeavouring to put an end to the robbery of the gas consumers, and to the designs of those who are looking to handling surplus profits of the electricity undertaking for purposes other than those for which they should be utilized. The report given in the "Journal" last week, under the heading of "Profits and the Rates at Manchester" (p. 196), shows that the Chairman of the Electricity Committee (Mr. Haworth) holds very sensible views on the subject, and is just as much opposed to the Gas Committee handing over £50,000 per annum (last year it was made up to £60,000, by taking away practically the remnant of the reserve fund) as he is to the handing over of £12,000 from the profits made by the Electricity Department. There are some members, however, who are not satisfied with what the Electricity Department are doing in the way of profit provision for the City Exchequer. What brought Mr. Haworth to the front in regard to the matter was that Alderman Holt, on a proposal to spend an additional £40,000 on the electricity concern expressed the opinion—more for the purpose of impressing the fact than anything else—that some 2 millions sterling having been expended on the concern, it was about time there was a return of profit in aid of the rates. The "Electrician" mentions that the Manchester Tramways Department has handed over to the City Fund £320,000 during the past six years; but since the gas-works have been in possession of the Corporation, Mr. J. G. Newbigging was telling us last November, the extractions from the gas consumers in aid of the rates total to £2,918,585. This is a shameful condition of things, and as defenceless in one department as another. Committees trading in gas and electricity should combine to make a stubborn and general fight against a system that favours indirect taxation, is prejudicial to the best interests of the undertakings and to the supply to the community of the two essential commodities at the lowest possible prices, and is hostile to the uniform treatment of gas and electricity consumers.

There is a little fear on our part that many gas undertakings are not doing all they might in offering resistance to the inroads of electricity in public lighting. The cause of this slackness we do not know. Is it apathy, or a disinclination to spend a little in preserving the public lighting for gas? It passes our comprehension when we read of a resolution to convert some 125 gas-lamps in a borough from gas to electricity, with the result that the illuminating power will be increased per lamp from 15 to 60 candles. Such a number of gas-lamps must be (seeing also that the electricity supply cables are in their neighbourhood) somewhere near the centre of the town; and yet their illuminating power is reported to be only 15 candles, which power raises visions at once of flat-flame burners. We cannot understand this. Many a gas undertaking might take a leaf in this connection out of the book of the South Metropolitan Gas Company. Their policy through long years has been not to wait to

be asked to make improvements, but to submit an offer themselves, and to include inducements that command the attention of the local authorities, and, as a rule, with favourable result. To this we attribute the comparatively small extent of public lighting by electricity in the area of the Company. At the present time, the Company are, on very acceptable terms, pushing the inverted burner for public lighting; and wherever one travels in their extensive gas-supply area, evidence of success in this direction is found—the improvement in illuminating effect being very marked.

Speaking of public lighting, we cannot refrain from strongly protesting against the grossly unfair treatment that has been meted out by the Chichester City Council to the local Gas Company in connection with the public lighting contract, and which there is no doubt the latter have lost solely through the preferential treatment of the Electricity Supply Company, by allowing them to depart from the advertised conditions of contract, and not extending a similar concession to the Gas Company. The Council's invitation for tenders was "for one year and upwards." The Gas Company complied with the request; while the Electric Supply Company's tender was conditional on the Corporation entering into a firm five years' contract. On learning this, the Gas Company naturally requested to be allowed to tender in the same way—for five years certain. But a majority of the Council absolutely refused to let them do this; their excuse being that it would be unfair after the Gas Company had learned the amount of the tender of the Electric Supply Company. It lies ill in the mouths of a majority of the Council to talk of unfairness in this way, when they themselves originated the whole of the unfairness with which the contract is surrounded, by not compelling adherence to the terms of the invitation to tender. The Gas Company, complying with these terms, submitted a tender which left the option of duration of contract entirely in the hands of the Council; the Electric Lighting Company, by not conforming with the conditions of the invitation and making their offer solely conditional on a five years' contract, removed all option as to duration from the jurisdiction of the Council. And the Corporation submitted to this, reducing the terms of their invitation to a perfect farce, and laying themselves open to a charge of undue preference and gross unfairness, against which charge their own dignity and sense of justice ought to have shielded them. There having been one infraction of the terms was quite sufficient to justify another for the sake of equality. In this matter, however, both dignity and sense of justice appear to have been entirely absent. If tenderers cannot rely on a firm adherence to terms by public bodies, then things have come to a pretty pass in local administration.

There is rather an amusing reference to the life of tungsten lamps in the "Installation Notes" of the "Electrical Times," in which the writer apparently takes the minimum life of tungsten lamps at 3000 running hours—in fact, in his extravagance, he says their life may be "anything" from that figure "upwards"—suggesting the possibility of eternal life. The whole object the writer appears to have in view is to advise users to have wire lamps in place of carbon filament ones, on the ground that their longer life pays, quite apart from the question of efficiency. From our way of thinking, to take isolated examples of extraordinary longevity of tungsten lamps, and use their life performance for general application, is "not cricket." In considerable installations under fairly representative conditions, what with early collapses of filaments, and blackening of bulbs, the average life of metallic filament lamps has been found by us to represent a period somewhat distant from 3000 hours; and it is the average life that has some relation to the out-of-pocket expense of the consumer in the matter of renewal, and not the life of lamps that are fortunate enough to escape for a long period the besetting perils and dangers of this wicked world.

A paragraph, having a common origin, has appeared in the "Electrical Review" and the "Electrician." It is headed "Rinking by the Osram Light." The first words of the paragraph in the first-named paper are: "We have in several recent issues referred to the success of the metal filament lamp in ousting high-pressure gas . . . for the illumination of streets." The paragraph in our other contemporary commences with the words: "We have in several recent issues given evidence of the manner in which the metallic filament lamp is rapidly ousting high-pressure gas for the illumination of the streets." We have tried to find in both instances those "several recent issues" in which references and evidence appear of the ousting of high-pressure gas from streets by the metallic filament lamps, and have to plead failure. Perhaps the Editors of the "Electrical Review" and the "Electrician" will assist us by furnishing the dates and folios of the "several recent issues" referred to, in order to satisfy our natural curiosity and remove our ignorance of the reported ousting. Perhaps, however, it will be easier to quote the pages on which references appear to the ousting of arc lamps by high-pressure gas in the area of the Westminster City Council. The references in the "JOURNAL" last week will be found on pp. 159 and 192. By the way, too, the Jandus flame arc lamps that were experimentally installed in Victoria Street, Westminster, were being removed a few days since.

At the meeting of the Society of Engineers (Incorporated) next Monday, Mr. R. O. Wynne-Roberts, M.Inst.C.E., will read a paper in which he will deal with the application of tar to roads.

HORIZONTAL CARBONIZING CHAMBERS FOR THE WHOLE GAS SUPPLY OF A TOWN.

A REPORT has been given in a recent number of the "Journal für Gasbeleuchtung" by Herr O. Peischer, the Manager of the Innsbruck Corporation Gas-Works, as to the results of three months' experience with the town supply of gas exclusively by manufacture in large horizontal carbonizing chambers or ovens. The author stated that so far as he was aware this was the first instance of a town being solely supplied with gas from such carbonizing chambers, though at Rotterdam and elsewhere part of the gas supplied was manufactured quite satisfactorily in such chambers.

At Innsbruck the former carbonizing plant is being replaced by new plant of a productive capacity of 15,000 cubic metres (529,724 cubic feet) per diem. The new plant is to consist of six beds of horizontal carbonizing chambers or ovens on the Koppers system. Up to the present time four beds, each containing three chambers, have been erected. The chambers have an extreme length of 5 metres (16 ft. 5 in.), and an available length of 4·11 metres (13 ft. 6 in.). They can be filled with coal to a height of 2·5 metres (8 ft. 2½ in.), and thus hold 74 cwt. 90 lbs. of Saar coal per chamber. The time required for carbonization is 24 hours. The new beds started work on the 27th of October, 1909, and up to the end of January produced 4,215,750 cubic feet of coal gas; the maximum daily production being 525,133 cubic feet, and the minimum daily production 261,330 cubic feet. During this time all four beds of chambers were in action; but, in order to accommodate the make to the consumption, one bed was at times left for 48 hours without drawing the charges. The consumption of fuel for the bed when the charge was left in for 48 hours amounted to 43 cwt. 34 lbs. of coke, compared with 31 cwt. 55 lbs. per charge when the carbonization is completed in 24 hours. The walls of the chambers are heated uniformly, and the regulation of the heat presents no difficulties. One bed of three carbonizing chambers was capable of readily producing 3500 cubic metres (123,600 cubic feet) of gas per diem.

An eleven days' trial carried out with care, when the plant was taken over from the constructors, gave the following results: The make of gas at 60° Fahr. and 30 inches barometer amounted to 11,788 cubic feet per ton of Saar coal; the gas having an average gross calorific power of 633 B.Th.U. per cubic foot. Hence the calorific valuation figure is 7,461,804 B.Th.U. per ton of coal carbonized. The consumption of ash-free and dried coke in heating the chambers amounted to 12 per cent. by weight of the dry coal carbonized.

Three months' working of the chambers gave the following average results: The make of gas per ton of wet or air-dried coal as charged into the chambers amounted to 10,980 cubic feet at 60° Fahr. and 30 inches; and the gas had a gross calorific power of 633 B.Th.U. per cubic foot at 60° Fahr. 30 inches and moist. The production of coke was 70 per cent. by weight with about 5·5 per cent. of slack and breeze. The tar obtained amounted to 5·6 per cent. by weight of the coal carbonized, and was of a thin freely fluid character and free from pitch. The ammonia produced amounted to 0·22 per cent. by weight of the coal carbonized. The fuel consumed in heating the chambers amounted to 16·41 parts by weight of coke (including ash) per 100 parts of coal as charged into the chambers; so that 53·59 parts of coke per cent. of coal remained for disposal. It should be remembered, in considering these figures, that the carbonizing plant was not utilized throughout to its full capacity. It is to be observed that the working of the carbonizing chambers depends on regular exhausting of the gas according to the make and the calorific power required. The latter should be subject to continuous control during working. The calorific power of 633 B.Th.U. per cubic foot is high compared with Professor Bunte's suggested standard of 5200 calories per cubic metre at 0° C., 760 m.m. and dry (543 B.Th.U. per cubic foot at 60° Fahr., 30 inches, and moist); and it would be easy to obtain a larger make of poorer gas. But, having regard to the high position of Innsbruck and the low atmospheric pressure (averaging 27·95 inches), it is considered desirable to supply a better gas than usual, in order that the consumers may not be prejudiced.

The fact that the carbonization extends over 24 hours is advantageous, as the stokers cease work at 6 o'clock in the evening, and only one attendant remains at night to keep the producers charged, and to look after the exhauster and seals. On Sundays and holidays work ceases at 3 o'clock in the afternoon—sometimes even at 12 o'clock. In such case, although the charging extends over only five hours, and gasification proceeds without attention for nineteen hours, the make of gas and its calorific power show very small variations from time to time. The fluctuations in the make are greater with any system of retorts than with the carbonizing chambers; and the variations in calorific power of the gas distributed are not with the last-named system ordinarily more than about 16 to 22 B.Th.U. per cubic foot.

The fears expressed by opponents of the large chamber system of carbonizing, as to the great variation in the make and quality of gas from such chambers, have been found by practical experiences at Innsbruck to be without foundation. There has been no difficulty in ejecting the slabs of coke from the chambers;

though serious difficulty was not anticipated, owing to the fact that in coke-works the charge is ejected from chambers 33 to 50 feet in length without trouble and without injury to the walls of the oven. There is practically no formation of scurf; so that it is unnecessary to burn it off. There has been no trouble from stopped ascension pipes. Each pipe is burnt out, and cleared with the auger, before the chamber is re-charged. A pipe is attached to the top of the ascension pipe when the deposited tar is about to be burnt off from the pipe, so that the smoke produced is carried up to a considerable height.

Practically, no thick tar is deposited in the hydraulic main; but what there is—amounting to perhaps a bucket-full—is removed once daily from the four mains. This good result is partly due to the fact that the hydraulic mains are flushed with tar instead of water. Though the settings and hydraulic mains stand in the open, exposed to the cold and rain, stoppages and deposits of pitch have been conspicuously absent. This is the more remarkable as the gas passes to the exhauster house through an exposed 20-inch main, 250 feet in length; and it is consequently often cooled to as low a temperature as 46° Fahr. The tar is thin and clean, and will be used in place of oil as fuel, though investigations are in hand as to its value for other purposes.

In regard, generally, to the exposure of the bench of chambers (without any roof) to the weather conditions prevailing, it would be premature to express a final opinion until a longer experience has been had—particularly as the past winter has been comparatively mild. There have, however, been heavy snowfalls, and the temperature has fallen as low as 4° Fahr. without the working of the chambers having been affected. If the coal used is very wet, it is necessary to increase the vacuum on the chambers by about 1-10th inch. Speaking broadly, the experience has been wholly favourable as compared with the working of retort-settings; and the open position of the installation has been beneficial to the health of the stokers.

The cost of the plant—including foundations, flue, chimney, and gas outlet main, coal preparing and conveying plant, and coke stage—amounted to £14,875. Allowing a reserve of one-sixth, the make of gas would average about 618,020 cubic feet per diem; so that the cost of the carbonizing plant per 1000 cubic feet of gas made per diem would amount to £24 1s. 4d. In the same conditions, the cost of inclined retort-settings amounted to £21 12s. 6d. per 1000 cubic feet; of vertical retorts, £31 9s. 4d.; of inclined carbonizing ovens, £40 2s. 3d. There is a great economy in wages compared with horizontal retort-settings; but the lowest figure quoted for wages for vertical retort plant has not been attained, partly because self-closing doors have not been employed. In this installation, the doors are luted with clay just as in coke-oven works. At present the four beds of three carbonizing chambers require eleven men, including the foreman, per 24 hours, which does not include the removal of the coke from the coke stage. But the same number of hands could quite well operate five beds of these carbonizing chambers; and the make of gas per diem per man would then be 56,500 cubic feet.

The new works is noteworthy in that tar and liquor wells have been dispensed with, and the condensation products are collected in three exposed tanks. The condensed products from the hydraulic main and exposed foul main flow direct into the separating tank, while the tar and liquor condensed in the apparatus house are pumped from a small receiver into the same separating tank. No difficulty has been experienced from the effects of cold upon the products. The exhaust steam from the works' steam-engines has sufficed to prevent freezing of the liquor or thickening of the tar; and the overhead tanks have the advantage that they are accessible and can be kept absolutely sound, while the tar and liquor can be removed from them by gravitation. The overhead tar and liquor tanks did not cost more than tar and liquor wells.

Mr. W. J. Livingston, the Chief Clerk in the Chemical and Gas-Testing Department of the London County Council, desires to retire as from the 30th of June next. Mr. Livingston, who is now sixty years of age, entered the service of the Metropolitan Board of Works in February, 1868, and has therefore completed 42 years of service. The Establishment Committee, whose report which is to come before the Council to-day contains the foregoing statement, are advised that during his long official career Mr. Livingston has carried out his duties in an able and zealous manner; and in view of his faithful service, they cordially recommend the Council to grant him a retiring allowance of 40-60ths of his present salary.

In the "JOURNAL" for the 5th inst. (p. 49), we reproduced from "John Bull" a story to the effect that the City of London Electric Lighting Company, while advertising their electric radiators for heating purposes, had had their own offices fitted up with hot-water pipes. Our contemporary remarked that no doubt there was another side to the question, and expressed a desire to hear it. This has been gratified; for the current issue contains the following paragraph: "The City of London Electric Lighting Company wish us to understand that the reason why a portion of their Bankside works are heated by hot-water pipes, notwithstanding that they are advertising electrical apparatus for the purpose, is that they desire to utilize 'a considerable amount of heat in the boiler flues. Being a waste heat, it is cheaper than anything else—even electricity,' they say."

STATE AND MUNICIPAL TRADING.

By J. H. BALFOUR BROWNE, K.C., D.L.

[Abstract of a Lecture delivered before the British Constitution Association, April 18, 1910.]

In his opening remarks, the author laid down the proposition that one of the serious evils of state trading is that it puts a gradual end to private trading. As this is not only the life of a country, but the means by which trade is expanded, methods are improved, and enterprise developed; consequently the loss of this great spring of private endeavour and adventure is both serious and irreparable. He thought it was quite obvious that the results of this process of transfer of various enterprises from the nervous and muscular hands of individuals into the fat and flabby hands of the state or the town, would inevitably produce less employment for the people, lower wages for the workers, increased cost of the necessaries of life to the consumers, and in the end put a tragic close to the personal freedom which we had enjoyed in the past. He then proceeded to give instances of municipal trading and state interference in support of his proposition. He pointed out that though there is a marked desire on the part of corporations and local authorities to get paying concerns into their hands to relieve the rates, there has never been any indication of a wish on the part of such authorities to adventure in a new field of enterprise. In almost every direction, public wants had been met and catered for by private adventurers. Gas, water, tramways, and electricity for lighting and power were in private hands in their early days, and the risk of the enterprise was taken by individuals; all that the local authorities did being to put spokes in the wheels of their progress. They closely watched these undertakings; and when a gas company went to Parliament for further powers, the corporation would insist on the new capital being raised at the cheapest possible rate—gas of the highest illuminating power being supplied at the lowest price, and clauses being inserted in the Bill preventing the presence of sulphur compounds in the gas. It had, however, been more recently discovered that the insistence on the part of local authorities of a high candle power and on the absence of sulphur compounds was a mistake.

Referring next to the action of the State in acquiring the telegraphs, by which the country had lost £10,000,000, Mr. Balfour Browne said the fact of there being in 1906 a deficit of £439,000 in this respect was evidence of non-success. The State was, however, incapable of learning by its own failures; and it was to take over the telephones, after crippling the early progress of this enterprise, and was to purchase on a certain "appointed day." Another illustration of fumbling and inept management of such undertakings in public hands was that of the London Water Companies, whose property was acquired by the Metropolitan Water Board on certainly reasonable, and in some respects advantageous, terms after a careful arbitration. But the result of the public management of these undertakings was that in 1904 the Board had to go to Parliament for authority to increase the charges; and the people of London had been called upon to pay more for their water than they would have done if they had kept the much-abused Companies as their servants. He suspected that the history of the Port Authority which Parliament substituted two years ago for the various London Dock Companies would run lugubriously parallel. Private enterprise was being shouldered out everywhere by corporate or state encroachment; and this furnished the reason for money now seeking investment not remaining in this country, but being tempted away by enterprises over the sea. The result was that the benefit of the initiative and adventure characteristic of individual or company speculation was lost, and we had in its place the steady, stagnant, and not very successful plodding in old ruts which was characteristic of public bodies.

The lecturer went on to point out that other important questions have emerged in this controversy. To-day the hope of the Fabian Socialists is to accomplish their malign ends through the municipality or the state. They see that the appropriation of certain great instruments of production by the country or by the town is a step in the direction of socializing all the means of production, distribution, and exchange; and they strive to further this process by every means in their power. On the other hand, there are many well-disposed persons who see that certain social reforms are called for by the real necessity for improvement in the conditions of life in various directions—people who have been hesitating as to whether they should proceed along the lines of what some have regarded as recent advances, lest we should go too fast and too far towards the accomplishment of the Socialist ideal. In this connection, the lecturer thought some further consideration of our present position in relation to state and municipal trading might be useful. He pointed out that there are two schools of Socialism—one which seeks to reach its deplorable ends by means of revolution; and the other which desires to attain the same objects by evolution. One is the impatient, the other the patient, school. He went on to show that one of the objections of the revolutionary Socialists to the tamer methods of the Fabians is that in municipal and State adventures the object is "profit" and not "use." But he pointed out that there are cogent indications that the policy of "use" as contrasted with that of "profit" is going to have its way. It had, he said, been stated that what seemed to be a profit was in some cases only one

in appearance, and was secured merely by a nimble method of keeping municipal accounts. If, for instance, a municipality ignored the fact that machinery depreciates, and that there ought to be a fund created to replace it at the end of its life, it was easy to show a profit. No commercial undertaking in the hands of a company could continue to exist for long with such a method of securing dividends; but it was different in the case of a municipality. In this connection, the lecturer cited this case:

A corporation embarked on a great water scheme for the supply of the town and surrounding district with pure and wholesome water. It was a great enterprise. But to-day it has to supplement the amount it receives from water charges by rates upon the occupiers within the municipal area, which bring in £64,000 a year. Here we see that the ratepayers in the town bear the loss, while the consumers of water outside have their water at less than cost price. But this great town is content; and when it gets eloquent, it says it gets its dividend in health and not in cash. In many cases, municipalities are forbidden to make any profit out of their water undertakings; and where a surplus does accrue, they are bound to apply it in the reduction of the water charges. Here, then, we have a change from the commercial undertaking which is worked for a profit to the social undertaking which is worked for use; and by means of evolutionary Socialism the ideal of the revolutionary Socialists is being attained.

The lecturer cited the case of a certain gas undertaking last session to show that the same tendency is seen in other directions. There a Committee of the House of Lords refused to pass a Bill unless it was so modified as to compel the promoting Corporation to run the gas-works for use and not for profit. The same thing was done by a Committee of the House of Commons in the case of the Oldham Corporation Bill of 1909, and by another Committee of the same House only a week or two ago in the case of the Glasgow Corporation Gas Consolidation Bill, 1910. He said his view was that the Committee really did this because they disapproved of municipal trading; but their protest came too late. He pointed out that if their action had been embodied in an Act, it would have had the effect of socializing the undertaking, to the delight of the advanced Socialists. But, as a matter of fact, the Bill was withdrawn.

After a few remarks explanatory of the sliding-scale in operation in connection with gas undertakings, the lecturer said this would be a perfect system if the increase or reduction in the price of gas all depended upon the care or the carelessness displayed in the conduct of the business. But it did not. He thought a fair standard price could not be fixed. He explained that he referred to the principle of the sliding-scale to show the suspicion with which profit is now looked at; and that was the Socialists' point of view. They did not want to see undertakings worked for profit, which, according to them, meant that the employees are sweated slaves, but for use, which meant that all the means of production, distribution, and exchange are to be enjoyed by the people, and are not to be worked by a system of profit and wages, but by one of equal division of the fruit of labour. "But what is profit?" asked the lecturer; and he answered his question thus: "It is the driving-wheel of all real industrial enterprise." Under the New Socialism, however, we are on the way to abolish profit all round, and work our undertakings for use. But where does the argument for municipal trading stop? Not at gas, water, electricity, or tramways. "Why," asked the lecturer, "is it not as true of boots, clothes, bread, and beer? This is what social reformers on their glassy slide will not open their eyes to; but it is thoroughly appreciated by the Socialists who are achieving."

The lecturer then proceeded to consider in some detail what this social reform or this Socialism means; and he showed that where there is no longer an incentive before a man, as there is in the existing capitalist system, there must be some stimulating force behind him. The paramount question was: "Which of the two systems is the best for the man and the nation?" The answer he would unhesitatingly give was: "The one which induces men to put forth their best energies with a hope, instead of that which makes them put forth their reluctant energies under fear." It was impossible to get good work, even of the lowest kind, out of slave labour; but the best work, and of the highest kind, could be obtained from individual enterprise. The Socialist system, to which municipal trading tends, was, in his opinion, the death-knell of character. If there was no character, there could be no achievements; and the nation which had for long been in the van of progress would "sink into a nation of barrack-yard slaves drilled by officials, oppressed by a system, and in the end obliterated from the face of a smudged earth."

In the next portion of the lecture, Mr. Balfour Browne considered at some length the injurious effect upon the individual by the removal from him of responsibility, and transferring it to the State. He pointed out that the State can only take these burdens upon its Atlas-bent shoulders while it is prosperous. When we come to the down-grade "the ghastly difficulties will face us, and the means of meeting these enormous obligations will fail us." The wealth of the country depends upon the productiveness of its labour. In the lecturer's opinion, "we are putting a saddle on the back of labour which may be too heavy for it to bear; and when it falls beneath its load, then we are in the hurly-burly of revolution."

Some other aspects in which Mr. Balfour Browne considered it worth while to review the tendencies of the times, especially in connection with the Labour Party, were next submitted to his audience; and the lecture closed with the following remarks: "In all these respects we have, by our municipal and state trading, been here coaxed on to the down-grade. We are in every direction playing at Socialism, and the comedy is very apt to become a real tragedy; for I cannot regard anything as more tragic than the stagnation, the decay, the disintegration of a nation. These catastrophes would result from the death of Individualism, from the injury to national character which is being brought about by our present apotheosis of the State."

A TAR AND AMMONIA WORKS ABLAZE.

By William Key.

Formerly Manager of the Tradeston Gas-Works, Glasgow.

In a moment, daylight seemed to disappear; and glancing upwards, a fearful pall of densely black smoke was rising skywards and spreading over the City from our very vicinity. The sight was an appalling one; and the author at once perceived that his best neighbour over the road was in trouble. Hurrying from the gas-works into the yard of the Company who received and worked up the secondary products, he was alarmed to find that the whole stock of pitch was ablaze. Not one of the Company's employees could be seen; and, hastening into their offices—thinking that someone might be securing valuable effects to remove to a place of safety—to his surprise the author found himself the sole occupant of these extensive works, and in possession of a huge furnace of blazing pitch, which was melting, and spreading, and spluttering over the yard.

Every second seemed to increase the dimensions of the blaze; and one instantly recognized that the officials and workers who had disappeared knew best the nature of the possible dangers from which they had escaped—there being on the works large stocks of refined oils, naphthas, crude oils, and tar, stored in circular brick tanks under the surface of the yard, in positions unknown to outsiders.

At present, without doubt, the most alarming prospect was of what might happen within the unoccupied upper portions of these tanks, where any possible explosive mixture of atmospheric air and spirit vapour, by being ignited, would explode and, blowing up the yard under foot, lift us higher up. The need for immediate action was imperative, and the author summoned a large number of men from the yard of the gas-works, and ordered them to bring with them twenty or thirty pails. The men were set to remove from the tar-works fifteen or more empty barrels; and these were ranged on end along the outside of the tar-works wall, nearest to the greatest volume of burning materials. Planks were placed on these; and men were stationed on the planks in readiness to handle the pailfuls of fire extinguisher.

Leading the remainder of men with pails to the ammoniacal liquor stored in a number of old Lancashire steam-boilers raised on brick piers, each having a draw-off cock at one end, the pails were filled as rapidly as possible, and the author directed the application of the liquid by delivering it with a spreading motion. The result was that, although the flames were blazing up most furiously, every pailful on alighting as instantly extinguished the flames over the area covered. Every pailful told; and where applied the flames at that spot remained suppressed.

In this way, we were making good progress when the Captain of the Fire-Brigade, with his men, and several engines, came thundering alongside. The Captain issued his orders for applying water through his hose-pipes, when the author informed him that he it was who was in charge of the fire, and held himself responsible for whatever occurred, and would certainly never permit a single stream of water to be applied to the flames—explaining to him, seriously, what would occur should great volumes of water be directed into the blazing works. The water would, he pointed out, pour down into the underground stock tanks, and up would come the spirit, oil, and tar; so that the second condition of the fire would be a thousand times worse than the first, besides the danger to all around from explosions. After serious demur at interference with his own department of duties, the Captain finally withdrew with his brigade.

Having extinguished the whole burning pitch within reach of the pailfuls of liquor from outside the walls, the author led the men to attack the remainder, which was approachable only from within the yard. In doing this, it was necessary to tramp through thin flowing and partly burning pitch—thus getting one's boots and clothing splashed with it. But the success of the application of the ammoniacal liquor had given such confidence that every man valiantly faced the flames, knowing they would instantly go down before their well-aimed discharge from the buckets.

Had these works been totally destroyed, the gas-works for a time would have had to cease gas-making operations; for, excepting the 12-inch pipe through which all the secondary products flowed into the chemical works in a steady stream, day and night from the gas-works, there was no other provision by underground tanks within the gas-works, or of pumps, or sets of railway rails, on which might have been brought in railway tank-waggons by which to remove the secondary products as these accumulated.

Hence to the author the serious predicament of the gas-works through the probable destruction of the tar-works by fire was incentive enough to use every effort to extinguish the blazing pitch, and save the works; and by the success of the voluntary service which he undertook, he was sensitive that his effort was "twice bless'd"—to those who gave, and those who received (the secondary products).

A CHEAP GAS-LIGHTER.

ATTENTION has been drawn by Messrs. J. & W. B. Smith, of Farringdon Road, E.C., to a patent gas-lighter which is so moderate in price, and withal so simple in action, that it should speedily win its way to popularity. A neat little appliance which will spark on being merely treated as though it were a pair of sugar tongs, and which can be purchased retail for the sum of about sixpence, should surely find a ready demand, if reliable in operation; and the one that has been sent in for inspection

A Simple Gas-Lighter.

certainly does do what is desired of it. As to the "life" of the sparking arrangement, it is too early to speak from personal knowledge; but if it is anything like as long as is claimed, the use of the appliance should prove economical as well as convenient. It would be impossible to describe the lighter in any more detail than is conveyed by the accompanying illustration; and therefore, with these few introductory remarks, we will leave the drawing to "speak for itself."

THE "VISSO" GAS-BURNER.

READERS cannot fail to be interested in the "Visso" burner, the exploitation of which in this country is being carried on by Messrs. Marse and Co., Nos. 45-46, Imperial Buildings, Ludgate Circus, E.C. The burner is of French origin; and having put to visual test practically the whole range of sizes in which the burner is constructed, we are not at all surprised that it has achieved considerable success in the land of its birth. It is an upright burner; and why it is that it, when lighted (without a mantle), gives a splendid, silent flame of bulbous form, and, when fitted with a slender mantle, the whole of the latter to every particle is rendered incandescent, and a brilliant light is thus obtained —giving, in terms of consumption and illuminating power, a high efficiency—is not apparent at first glance. But, on examination, the main secret appears to be that there is a double mixing of gas and air, which produces a thorough admixture, and consequently perfect combustion. We would suggest another reason; and it is that the cone-shaped cap on the gas-injector at the bottom of the burner, and the slight constriction in the centre of the bunsen tube, together increase the velocity of the uprising mixture to the point of combustion. Supplementing these features are the well-made character of the burner, and the proper proportioning of the parts for the work the burner is designed to perform. Looking at the bottom of the burner, there is the gas-nipple with a single hole; and we may pause here to remark that the firm prefer that, in ordering burners, both gas pressure and quality should, if possible, be stated, so that they may supply the nipple that is best suited to the conditions. Only by having the proper nipple can the best economy and efficiency be assured. There is a circular casing round the nipple perforated with air-admission holes; and upon this casing is screwed a cone-shaped cap with outlet at its apex. At the bottom part of the bunsen-tube are rectangular air-admission slots, with a vertically sliding regulating-collar. Now the result of this construction is that, in the small interior chamber formed by the nipple casing and cone, there is a preliminary mixing of the air and gas; and this mixture, issuing from the top of the cone-shaped cap, sucks up a further supply of air through the annular passage formed by the air-regulating collar and the cone cap, and the mixture is completed, and the velocity (so we think) of the supply is augmented through the special construction. And in these features is the secret of success, and of the economy in producing a high efficiency. The burner head is constructed with a removable cap topped with gauze; and caps can be obtained for renewal at quite trifling cost. The burner itself is turned out of the solid; so that, with the only part likely to be affected by the heat being so readily and cheaply renewable, the burner may be said to be practically everlasting. The mantle is suspended by a side hooked wire, which is held in position by a thumb-screw; and by it the mantle is maintained centrally over the burner.

There is novelty in the sizes of the burners, and in the mantles required for them. The burner is at present made in seven sizes; and an eighth size is being arranged for. The smallest burner at present made consumes about 1¼ cubic feet an hour; and the largest size about 10 cubic feet. Of course, the consumption and the efficiency vary with the pressure and the composition of the gas. It is found that the best efficiency is secured with gas at about 2 inches pressure; but the burners work quite well under pressures ranging between 7-10ths and (say) 5 inches. The smallest burner will, we are informed, return an efficiency of 30 candles per 1¼ cubic feet of gas consumed; and a fair average figure to take would be the equivalent of 250 candles with an hourly consumption, in the large burner, of 9 to 10 cubic feet of gas. According to the results of some tests made by gas experts in Paris, and received only a few days since, with a pressure of just under 2 inches, and a consumption of 2·8 cubic feet, an illuminating power of 92 candles was realized, using the No. 3 burner. There are the five intervening burners; but the novelty and usefulness of the smaller sizes, with their pencil-diameter mantles, are features that are creating a big demand. They are quite sufficient for landings, lavatories, small bedrooms, and so forth; and in their production, the same care is exercised to secure the best service as is the case with the larger sizes. There is a demand for yet a smaller size; and, at the present time, the firm are working on what will be known as the No. 00 burner, with a consumption of just over ½ cubic foot, and giving an illuminating power of (it is computed at present) about 17 candles. This descent to such small size is an aid to domestic economy. It is a point that the electricians are constantly making in connection with incandescent electric lamps, that a good range of sizes of lamps suited to any particular purpose and position is helpful to economy. The "Visso" gas-burner claims to meet all the commendation in this respect of the electric incandescent lamp, with much more economy to the householder. The No. 4 burner, using about 5 cubic feet of gas, is specially recommended for street and other outside lighting.

The mantles used are specially made for the burners. They are of smaller diameter than the ordinary ones; and a coarse thread is used in the production of the fabrics, which feature, it is claimed, gives an increased stability and therefore longevity to the mantles. But for factories and places where the mantles would be subjected to strong draughts and vibration, an exceptionally neat and flexible mantle is made with a silk base, but the cost is more than the ordinary form. The mantles it is seen fit the flames perfectly; and about them, as already said, there is no waste—every part being incandescent, which accounts partly, though primarily the degree of intensity of the incandescence is responsible, for the high efficiency obtained by these burners. The light appears rather more yellow than that from the ordinary incandescent mantle—an effect of the chemicals that are used in the impregnating fluid.

CARBONIZING IN HORIZONTAL RETORTS AT WORCESTER (MASS.).

IT may be remembered that the "JOURNAL" for Nov. 9 last contained some extracts from a paper read by Mr. C. D. Lamson, the President and General Manager of the Worcester (Mass.) Gas Company, before the New York Society of Gas Lighting, in which he gave the results obtained from Westmorland coal carbonized in horizontal retorts in the new retort-house of the Company. At the request of the Technical Committee of the American Gas Institute, the author read the paper at the annual meeting in October. Some additional data in regard to the house referred to were furnished by Mr. DANA D. BARNUM, of Worcester, in a paper read at the annual meeting of the New England Association of Gas Engineers held at Boston (Mass.), a short time ago.

Although considerable information in regard to the Worcester retort-house has been published, there is still much of interest that may be discussed. When we began to get the results which have since been confirmed by a year's working, it became apparent it would be necessary to check the simplest operations, to make sure we were not deceiving ourselves or anyone else.

Coal.—The question of the weighing of the coal was one of the difficult problems. The coal comes all-rail from the mines, is unloaded by a grab bucket, and placed either in the store or passed directly through a breaker, from the outlet of which it is taken to the storage bin in the retort-house, and is drawn from this bin into the hoppers of the charging-machines. It is weighed in the cars at the mines, also in the cars on scales on our siding; and the coal as used is weighed in the charging-machines in the retort-house. In order to check these weights, we ran for nearly two months, and obtained three separate weighings of the coal on different scales. To do this, each carload of coal was placed either entirely in the storage or in the bin in the retort-house; and, by starting and ending the test with this bin and the bins on the chargers in the same condition, we were able to check all coal used. These figures were very satisfactory, and agreed to within 2·2 per cent. In addition to the above, we made a survey of our coal pile, and this checked to within 0·5 of 1 per cent. of the coal paid for in twelve months. In doing this work, we obtained the weight of a cubic foot of coal as it lay in our store, by loading coal-cars with the coal from the store, and getting the weights and cubic contents of the cars.

Carbonization.—In order to study the conditions in the retort, a number of temperatures were taken. One set of readings of the pyrometer was taken by placing the end of the instrument through the mouthpiece, and extending it into the coal for about 10 or 12 inches. The gas leaves the retort at an average temperature of 1165° Fahr., as found by readings. As the temperature of the coal rises from 700°, the gas at first comes from the surface. This becomes carbonized and forms a crust or carbon skin, and with the retort at 2000° Fahr. the crust attains appreciable thickness about 30 minutes after charging. As carbonization continues, the crust increases in thickness, and fractures vertically near the

middle. This main fracture extends the length of the charge. Most of the gas is driven off through this fracture in an irregular sheet, and travels along the roof of the retort to the end. There are, of course, minor breaks in the coke; but the bulk of the gas goes off through the main fracture after it is formed. The expansion of the coal and the contraction of the coke depend to a large extent upon the temperature and rate of carbonization. With a charge of about 900 lbs., the coal will be from 8½ to 9 inches in depth. If the temperature and rate of carbonization are such as to just carbonize it in seven hours, the depth of the charge will reach its maximum in this time; but if the coke is allowed to remain in the retort another hour, it will contract about 30 per cent. of what it expanded.

Two charges, one of 900 lbs. of coarse coal and one of 1000 lbs. of fine coal, were left in for eight hours, and measurements of the space above the charge were taken every 30 minutes. The 900 lb. charge was thoroughly carbonized in less than seven hours, and the 1000 lb. charge in a little more than eight hours. These factors—viz., temperature, rate of carbonization, and pressure in the retorts—are the fundamental principles to which study and attention must be given, in order to obtain future increase in the candle-feet and heating power of the gas.

In studying the temperatures in the mouthpieces and the stand and bridge pipes, it became apparent that if the temperatures in the stand-pipes could be kept above the point at which the tar condensed out, there would be no subsequent baking of the resultant pitch; and by covering the pipes with insulating material, we have been able to carry all the tar over into the hydraulic main—leaving only a small amount of lampblack, which can be easily removed.

Producers.—In Mr. Lamson's paper entitled "A Pound of Coal," there is the following table:—

	Feet of Gas from Producer to Comb. Chamber.	Feet of Gas from Comb. Chamber to Retort.	B.Th.U. per Pound of Fuel.
Not breaking up CO_2	135	185	12,496
Breaking up CO_2	113	174	12,688
0·42 lb. of water per pound of fuel	75	140	12,453
1 lb. of water per pound of fuel	70	146	12,609

Columns 1 and 2 show the relative amounts of gas available for conveying the heat from the producer to the combustion chamber and to the retorts; column 3 shows the B.Th.U. per pound of fuel. The first case is an actual accomplishment in the Worcester producer. We know that, in the second case, in order to get the reaction given, it is necessary to have a temperature considerably above the temperature used in the calculations—viz., 1877° Fahr. We also know that as the temperature increases, the liability to clinker also increases. Now, if the producer is run at a higher temperature than 1877° Fahr., it will take more fuel to maintain the higher temperature in the producer, and the economy must be necessarily less, as no more heat can be obtained per pound of fuel than is shown in the table; and the same reasoning applies to the conditions when steam is used.

An important factor in the running of the producers is the removal of the ash as quickly as it is formed. It is as important to keep the fuel active as far down near the grates as practical, as it is to keep the producer filled with fuel. The theory is as follows: There is a central zone in the fuel bed which naturally has a tendency to assume the highest temperature. If the ashes are allowed to mount up so that the initial reaction takes place in this central zone, then the combination of the two tends to give a higher temperature; otherwise, if the ashes are kept low and the initial combustion takes place as near the grate-bars as is practicable, then the heat is more evenly divided, the temperature is lower, and a cooler producer is maintained. In checking the fuel results, we analyzed the coal and coke, and measured the amount put in the producers and that which was taken from the retort-house. This is regular routine work, and gave an average of 15·3 lbs. of coke per 100 lbs. of coal carbonized. To check this, a thermal balance of the stack was made, using 15·3 lbs. of fuel. In making this balance-sheet of heat units, the difficult figure to determine was the loss by radiation and convection. The radiometer could only be attached at certain places, owing to lack of room; and to determine the loss on the surfaces, where the instrument could not go, we made a curve of radiation for all points that we could determine, and then, by means of the curve and the skin temperature, which could be taken at all points, we were able to get the radiation of the entire surface. The following is the balance-sheet of heat units:

	B.Th U.	Per Cent.
Expended 15·3 lbs. of coke	195,519	82·6
Heat formation (*plus*)	40,539	17·4
	236,058	100·0
Accounted for—		
Carried up the chimney	41,165	17·3
In ashes	134	0·06
Carried by gas	14,586	6·0
Carried by tar	4,230	1·7
Carried by hygroscopic water	3,759	1 5
Carried by water formed	8,979	3·7
Lost by radiation and convection	82,643	35·0
In the hot coke	33,396	14·1
Heat of formation (*minus*)	3,966	1·7
Balance—gross heat of carbonization	44,779	18·9
		100·0

Net heat of carbonization per lb. of coal, 82·06 B.Th.U.

A study of the table will show that the only material loss is in radiation and convection. The loss up the chimney is not large, and any reduction in the radiation and convection will give some gain in this item, as the loss up the chimney is directly proportional to the amount of fuel used; and we see from the figures that further economy in the operation of producers for heating retorts must be obtained by reducing this factor of radiation.

Yield and Candle Power.—The station meter is 14 feet diameter, and was first tested by the gas company, then by Mr. C. W. Hinman, and finally tested and calibrated by the Nathaniel Tufts Meter Company. These tests, like all station-meter tests, were made at comparatively slow rates—15 cubic feet per minute; but we were able to check the meter by using a million-feet holder. This was emptied, the water-gas apparatus shut down, and all valves leading from one system to the other were tested. Coal gas was made and run into the holder until full. The temperature of the gas as passed through the meter was noted, and readings of the holder were taken before sunrise, when the temperature of the air was 5° below and 5° above the average reading at the meter. At 5° below, the holder showed 0·7 of 1 per cent. less than the meter, and at 5° above it showed 1·2 per cent. more. Having filled the holder, we had an opportunity to test the gas. It gave, with the new "F" argand burner, 16·25-candle power; calorific power, 624 B.Th.U.; sp. gr., ·439. We had made a number of tests in various ways. But those of the gas in the holder are what we relied upon to check all others; and they also prove that our regular method of sampling and testing gave correct results.

The daily testing of the gas is done in a photometer-room newly fitted up with modern apparatus specially for this purpose. Samples are taken from the inlet of the rotary scrubbers, and passed through a small purifier into a 5 cubic feet holder. To get an average sample, we proceed as follows: One-fourth of the retorts are charged every 1 hour 43 minutes; each charge thus remaining in 6 hours 52 minutes. Curves were made showing the rate of make for the 1 hour 43 minutes between each charging. The 103 minutes were divided into three parts, and a sample taken at the middle of each. These three samples gave tests which when averaged gave the correct value of the gas.

The following tables will show the rates of make for 1 hour 43 minutes, and the candle power with different burners:—

Yield 5·96 cubic feet per pound (corrected), after charging fourth elevation; seven benches; "F" argand burner.

	1st.	2nd.	3rd.	Average.
Candle power	17·9	17·35	14·4	16·5

Yield 5·96 cubic feet per pound (corrected), after charging second elevation; seven benches; "F" argand burner.

	1st.	2nd.	3rd.	Average.
Candle power	18·5	17·2	15·0	16·9
Per cent.	34·4	33·3	32·3	—

Yield 6 cubic feet per pound (corrected), after charging second elevation; ten benches; new "D" argand burner.

	1st.	2nd.	3rd.	Average.
Candle power	18·78	18·66	17·37	18·27
"Metropolitan" argand No. 2	19·53	19·48	18·50	19·17

It will be noticed that the amount of gas for each third of the time is very nearly equal to one-third of the whole, and that the test of the gas midway between the charges is close to the average of all the tests.

Candle Power with Different Burners.

New "F"	16·25
Old "D"	17·18
New "D"	18·30
"Metropolitan" No. 2	19·20

Conclusions.—(1) The generating of gas from coal is a heating problem, and resolves itself into the science of making producer gas. (2) This producer gas must be utilized in such a manner as to give uniform temperatures throughout the entire retort surface; and to do this a fire material of high conductivity must be used. (3) The charge of coal must be large, loosely laid, and evenly distributed, in order that the heat may penetrate evenly and quickly to the centre of the charge. (4) The gas as evolved must be taken from the retort immediately, and with as little pressure in the retort as possible.

The above factors, together with proper apparatus for their adjustment and close regulation, are the essential and salient features of the Worcester retort-house.

The Secretary for Scotland has appointed Mr. William S. Curphey to be Chief Inspector in Scotland for the purposes of of the Alkali Works Regulation Acts, 1881 to 1906.

At the monthly ballot for membership of the Institution of Civil Engineers last Tuesday, Mr. Stanley H. Jones, the Engineer of the Commercial Gas Company, was admitted a member.

At a meeting held at Hanley last Wednesday of several of the Committees of the Council of the new county borough of Stoke-upon-Trent, Mr. T. Mitchell (Burslem) and Alderman J. Shenton (Fenton) were chosen as Chairman and Vice-Chairman respectively of the Gas Committee, whose meetings will be held at Stoke. According to the "Staffordshire Sentinel," it may possibly be decided to connect the gas-works at Stoke, Longton, and Fenton, and use only two of them, except in particularly heavy seasons. With regard to the Burslem undertaking, it is thought that, from its position, it may require separate management.

SOME PRACTICAL ASPECTS OF RADIATION: HAVING REFERENCE TO THE USES OF ILLUMINATING GAS.

By J. G. Clark.

A Meeting of the London and Southern District Junior Gas Association was held last Friday evening at the Cripplegate Institute, E.C.—Mr. W. J. Liberty, President, in the chair.

Mr. J. G. Clark, of the Gaslight and Coke Company, read the following paper, entitled "Some Practical Aspects of Radiation: Having reference to the Uses of Illuminating Gas;" and in doing so, he amplified some of the points which might perhaps otherwise not have been quite clear to those of the members who had not previously given much thought to the subject dealt with.

Radiation.

Radiation is a form of energy which is believed to consist of vibrations of the ether, emanating from a source at which energy is produced by heat; and the study of radiation phenomena is therefore one essential to the education of those interested in the gas industry. It is a matter of common knowledge that if a ray of solar light is directed to a glass prism, its direction is changed, and it is said to be refracted. If the refracted ray is examined carefully, it will be seen that not only has its direction been changed, but it has undergone decomposition. The ray as it enters the prism appears but a simple mono-chromatic (*i.e.*, a single-coloured) ray, but on emerging, it is found to have been resolved into the primary colours—namely, red, orange, yellow, green, blue, indigo, and violet. This array of colours is known as the solar spectrum. Without going into the optical details of the phenomenon of light decomposition, it may be briefly stated here that the solar ray was not in reality mono-chromatic, but a compound of the primary colours in a certain proportion, all of which were refracted in passing through the prism, but in different degrees, causing the observed dispersion or separation to take place. By the use of special refracting media, a still higher dispersion of the colours may be brought about.

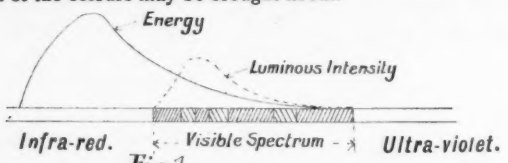


Fig.1.

A spectrum is shown graphically in fig. 1; and a point in which we, as suppliers of light, are especially interested is the photometric value of the different colours. Starting at the red, it will be seen that the photometric value or luminous intensity of the colours increases to a maximum at the yellow and green, and ultimately vanishes at the violet. I do not propose on this occasion to deal with the subject of the colour composition of the various sources of light; but it has some very important practical aspects, and may very well serve as a subject for discussion at some future date. The "luminous" curve in the diagram indicates roughly by its height the photometric value at the various points.

It should be stated that the spectrum is not limited to the rays which are visible, but can be shown by suitable methods to extend beyond both extremities. The invisible portions of the spectrum are known as (*a*) the infra-red and (*b*) the ultra-violet. If the spectrum is explored by means of a thermopile (which responds to thermal effect only) indications will be found in the invisible infra-red and in the visible regions; but none in the invisible ultra-violet. If a spectrum is explored by a sensitive plate (which responds to chemical effect only), indications will be found in the visible and ultra-violet regions, but not in the invisible infra-red. The spectrum may therefore be regarded as made up of three sections:—

(1) The infra-red (non-luminous but thermal) region.
(2) The visible or luminous and thermal region.
(3) The ultra-violet (non-luminous but chemical) region.

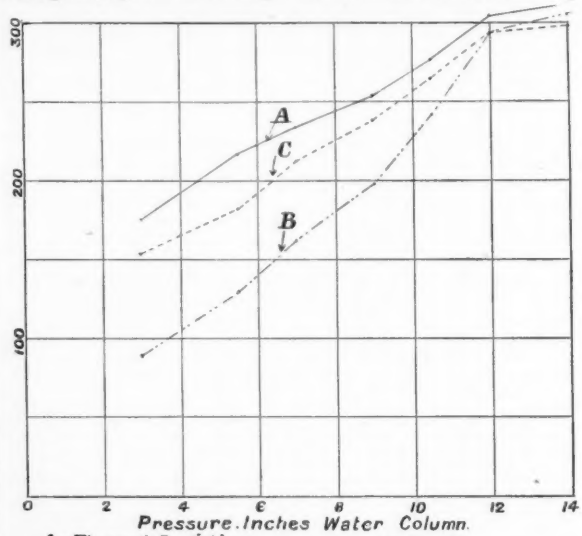
This classification must not be looked upon as scientific, because in all probability all three effects exist in some degree in every part of the spectrum. What is meant is that the particular effect specified is predominant at a certain part of the spectrum.

It is interesting to note that the proportions of the various effects vary very considerably with different sources of the radiation. Comparing, for instance, the radiation from the argand flame and that from an incandescent gas-burner, the proportion of thermal to luminous radiation is found to be larger in the former case than in the latter. The distribution of the thermal effect represents the distribution of energy in the spectrum; and it is a noteworthy fact that but a comparatively small amount of the total radiant energy of the best artificial sources of light lies in the visible region. Fig. 1 shows roughly how the thermal and luminous effects are distributed in the spectrum of artificial sources of light produced through the agency of heat—*i.e.*, gases, oil, electricity, &c.—and indicates how inefficient are even our most efficient methods of producing light. It is interesting to note, in passing, that, whereas the efficiency of the firefly, as a light-producing machine, is about 99 per cent., that of our most efficient commercial light-producing methods is probably only about one-tenth of this amount.

What are the practical aspects of radiation in regard to the uses of gas? By far the larger portion of the gas burnt is used to produce light and heat, and as, in producing heat for many purposes, endeavours are made to produce a large proportion in the radiant form, it is at once seen that the thermal and luminous aspects of radiation are important matters. No special endeavour has, so far as I am aware, been made to produce specially high actinic or chemical effects by means of gas, so that this need not now concern us.

We have seen that the three effects, thermal, luminous, and actinic, are different aspects of the same form of energy—*i.e.*, radiation. They have certain characteristics in common. For instance, they may be refracted, reflected, and polarized, and, for point sources, they obey the law of inverse squares. All these matters are adequately dealt with in the text-books, and need not be further considered here.

In dealing with the spectrum, it was mentioned as probable that all three aspects of radiation—*i.e.*, thermal, luminous, and chemical—exist in all parts of the spectrum; and we find in practical work that we cannot produce luminous effect without accompanying thermal effect, and we cannot produce any great thermal effect without accompanying luminous effect. What is possible, however, is to vary the proportion of the luminous and thermal effects, so that the required effect is made more prominent. As illustrating this, fig. 2 is interesting. These results were obtained by



A = Thermal Radiation
B = Luminous "
C = B/A
Fig.2.

observing simultaneously a photometer and a thermopile which were directed to an incandescent mantle fitted upon a burner. The observations were made at various pressures; and it is seen that both the luminous and the thermal effects increase with the pressure. But the former increases more rapidly than the latter. This is, of course, due to the higher flame temperature at the higher pressures, and is a practical example of the phenomenon of selective radiation. The reduced slope of the "thermal" and

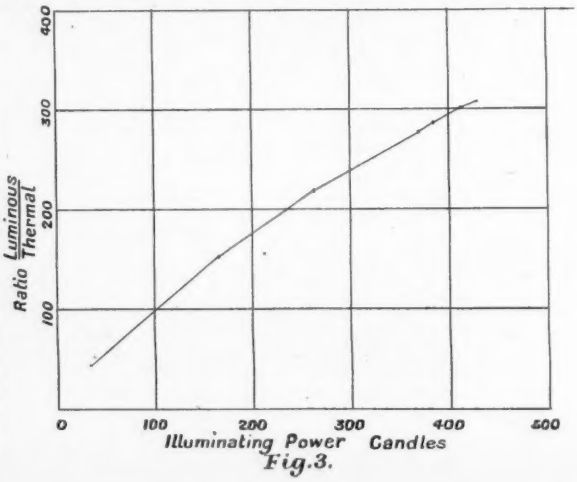


Fig.3.

"luminous" curves beyond 12 inches pressure, is due to the gas consumption exceeding the efficient limit for the mantle. For consumptions at pressures higher than 12 inches with the particular burner used, a larger mantle would have to be employed to develop the full lighting efficiency. Fig. 3 is similar to fig. 2, except that the pressure of gas was kept constant, and the temperature of the flame was varied by adjusting the air-ports. The proportion of luminous to thermal effect increases with the aëration of the flame.

Lighting Aspect of Radiation.

Lighting may be described as consisting in the production of luminous radiation at the lowest possible cost and its distribution to the best possible advantage. The methods of distribution of light are by direct radiation, reflection, and refraction, or (as is usual) by a suitable combination of these methods. I propose now to deal with the use of a few typical reflectors and their effects as distributors of light.

If a source of light is enclosed in a sphere, the whole of the radiation will be intercepted by the spherical envelope, and the photometric value of the light included within any angle will be the product of the candle power and the area of the sphere in that angle. For example, let the sphere be divided into latitudinal angles of 10°.

If the lines of latitude be drawn for each of the angles, the sphere will be divided into a series of zones, each of which is the surface corresponding to the respective angles; and if we assume the candle power of the light source to be equal in all directions, the photometric value in each direction will be proportional to the area of the zone. Although the angles are equal, the areas of the zones included in them are by no means equal, but can be shown to be related, as follows:—

Angle of Latitude.	Area of Zone Included Within Angle.	
0° to 10°	1736	See foot-note* for method of calculating these figures.
10° to 20°	1684	
20° to 30°	1580	
30° to 40°	1428	
40° to 50°	1232	
50° to 60°	1000	
60° to 70°	737	
70° to 80°	451	
80° to 90°	152	

Comparing, for instance, the zone included within the angle 0°–10° with that included within the angle 60°–70°, it is seen that the area of the former is 2·36 times that of the latter; so that if the distribution of the light over the sphere is uniform, the photometric value at 0°–10° will be 2·36 times that at 60°–70°.

For many purposes, the rays at and near the horizontal are not required in that direction; but as their photometric value is so high, it is obvious that if they can be redirected to an angle where they are required, a material advantage can be obtained. For instance, if a flux of 100 candles between 0°–10° could be reflected without loss to the zone included within 60°–70°, the increment at the latter zone would be 236 candles. We cannot in practice reflect with 100 per cent. efficiency; but the important value of the horizontal rays is obvious. As a practical illustration, fig. 4 is interesting. This represents the polar distribution of light from a cluster of inverted burners with and without an enamelled iron reflector A (see key diagram of reflectors). The reflector was arranged to intercept the rays to an angle of about 20° below the horizontal; the intercepted rays being reflected to the lower

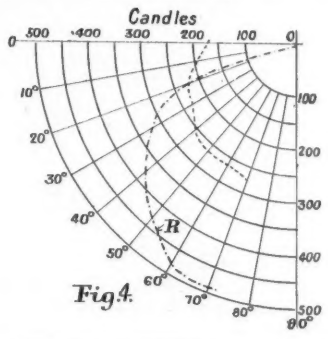
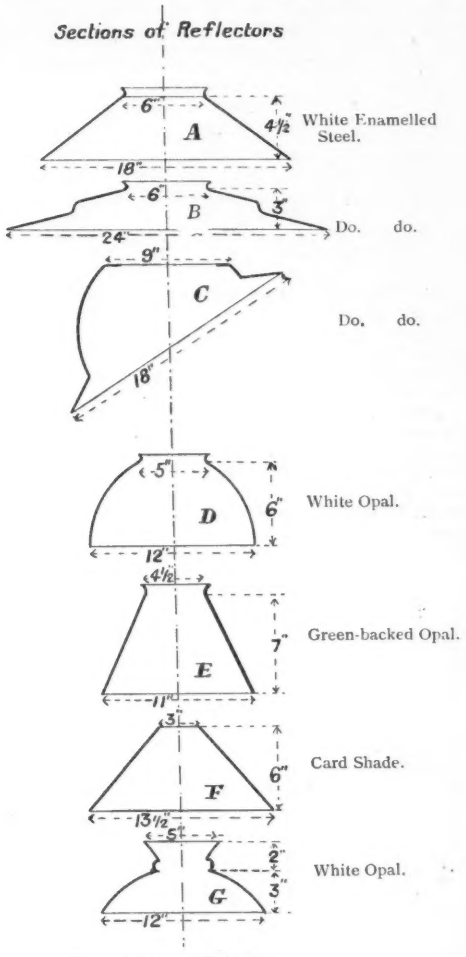


Fig. 4.



Key Diagram of Reflectors.

angles. Note the large increase of candle power there is at the lower angles, compared with the comparatively small loss near the horizontal. Fig. 5 represents the performance of a similar

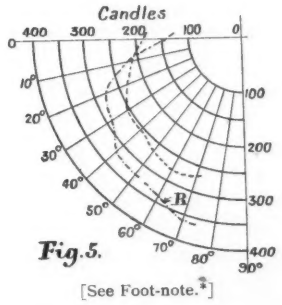


Fig. 5.

[See Foot-note.*]

cluster with the shallower reflector B. In this case, the light was intercepted to within about 7° below the horizontal, with the result that the increase in candle power at the lower angles, due to the reflector is not so great as with reflector A.

In passing, we may just note the difference between regular and diffused reflection. An example of the former is a polished mirror surface. A large quantity of light is reflected from such a surface; and, as the reflection is quite regular, images can be seen. An example of diffused reflection is a whitewashed wall. Although a large quantity of light is reflected, the reflection is

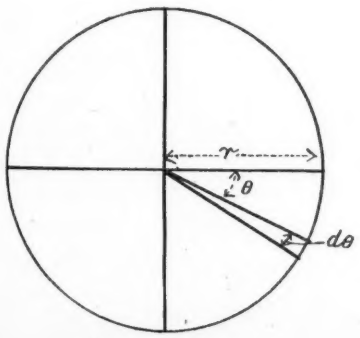
* Let A = area of sphere, then

$$dA = 2\pi r^2 \operatorname{Cos}\theta \, . \, d\theta$$

$$A = 2\pi r^2 \int_{\theta_1}^{\theta_2} \operatorname{Cos}\theta \, . \, d\theta$$

$$= 2\pi r^2 \left[\operatorname{Sin}\theta \right]_{\theta_1}^{\theta_2}$$

$$= 2\pi r^2 \left(\operatorname{Sin}\theta_2 - \operatorname{Sin}\theta^1 \right)$$



* The two curves in each polar diagram indicate the result with and without the reflector; that marked "R" being the result with the reflector fitted.

irregular; and, the light being scattered in all directions, no images are visible. A porcelain reflector is really a compound of a diffused and a regular reflector. The transparent glaze reflects regularly; while the matt surface of the porcelain beneath the glaze is responsible for the diffusion. I am not prepared on this occasion to deal with the phenomenon of diffused reflection; but it may form another subject for future discussion.

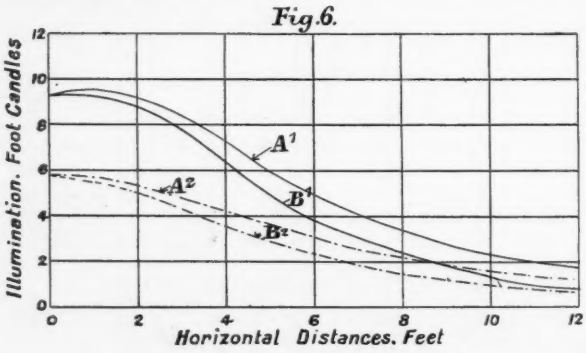
There is another aspect of lighting. I need hardly remind you that illumination has reference to the quantity of light falling upon a surface, and that the unit of illumination is the candle-foot. The candle-foot is the illumination that is produced when a light of 1 candle falls normally on a surface placed at a distance of 1 foot from the light source. It is an obvious inference from the law of inverse squares that the illumination in candle-feet is numerically equal to $\frac{\text{candles}}{(\text{distance in feet})^2}$, assuming that the rays fall normally on the surface. If the surface is inclined to the direction of the rays so that the angle of incidence is θ, then the illumination will be less than the normal in the proportion of 1 to Cos θ. The complete expression, therefore, for illumination is:

$$\text{Illumination in candle-feet equals } \frac{\text{candles}}{(\text{distance})^2} \times \text{Cos } \theta.$$

Illumination is a very important aspect of the art of lighting; and it may be considered in regard to three surfaces—*i.e.*, (1) the normal surface, (2) the horizontal surface, (3) the vertical surface. The particular surface chosen in evaluating a system of lighting will vary with the circumstances; but for many purposes the horizontal surface is referred to.

Further, it must be known whether the horizontal surface is to be coincident with the floor, or an imaginary surface at a given height above the floor. This will vary according to circumstances. Fig. 6 shows the horizontal and normal illumination calculated from the polar curves in fig. 4, and having reference to a plane 7 feet below the lamp—*i.e.*, a plane 3 feet above the floor if the lamp is 10 feet high.

Fig. 6.



A_1 and A_2 represents the normal illumination.
B_1 ,, B_2 ,, ,, horizontal ,,
In each case, the full line represents the result with the reflector, and the dotted line the result without the reflector.

A very useful type of reflector for shop lighting is that known as the parabolic reflector. The effect of such a reflector on the light distribution, when used with a four-light upright cluster, is shown in figs. 7 and 8. Fig 7 shows the effect of the reflector directly in front, and fig. 8 the effect at the sides.

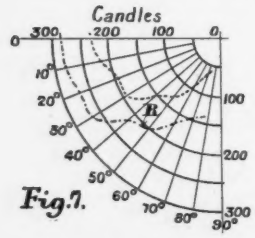


Fig. 7.

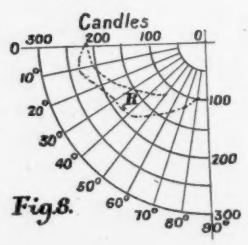
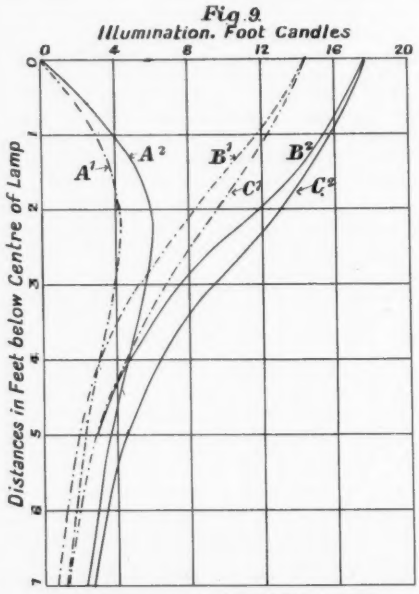


Fig. 8.

In calculating the illuminating effect produced by such a lamp when used to light a shop window, we have to consider three possible surfaces. If a shop window is observed, it will usually be found that the articles displayed in the upper part of the window are arranged vertically; those near the centre (a little below the line of vision) are inclined; and those at the bottom are nearly horizontal. To ascertain, therefore, the value of the parabolic reflector, the following values have been calculated for a vertical line 4 feet from the centre of the lamp, and directly opposite the reflector—*i.e.*, the illumination of the line is calculated with reference to the curve in fig. 7. (1) Horizontal illumination, (2) vertical illumination, (3) normal illumination. These effects are shown in fig. 9. Figs. 10 and 11 show the effects of the reflector D when used first with an upright, and secondly with an inverted, burner. In the case of the inverted burner (fig. 11),

Fig. 9.



A_1 and A_2 represent horizontal illumination.
B_1 ,, B_2 ,, vertical ,,
C_1 ,, C_2 ,, normal ,,
In each case, the full line represents the result with the reflector, and the dotted line the result without the reflector.

the direct rays were obscured to about 25° below the horizontal; while with the upright burner (fig. 10) they were obscured to about 5°.

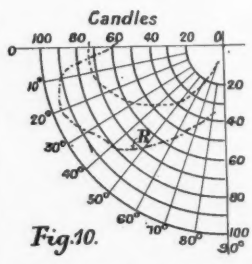


Fig. 10.

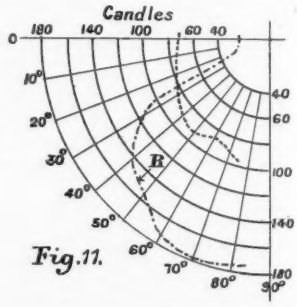


Fig. 11.

Figs. 12 and 13 show the effect produced by reflector E when used with, first, an inverted, and, secondly, an upright burner. This type of reflector is much employed when a comparatively small surface has to be well illuminated—for instance, a table,

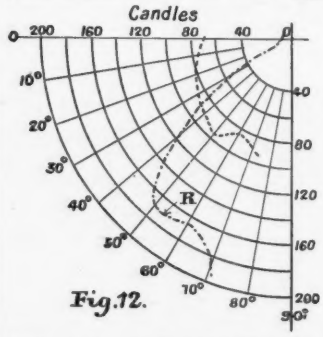


Fig. 12.

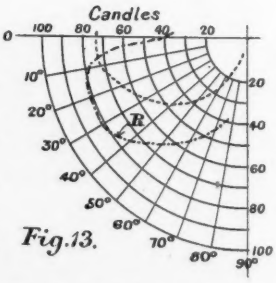


Fig. 13.

desk, or drawing board. Fig. 14 shows the effect of an ordinary 12-inch card shade (reflector F), when used with a "C" burner. Fig. 15 shows the effect of an ordinary opal shade (reflector G), when used with a "C" burner.

In concluding my remarks on lighting, I may say that all the photometrical measurements were made by a Simmance-Abady "Flicker" photometer.

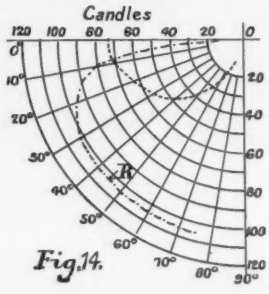


Fig. 14.

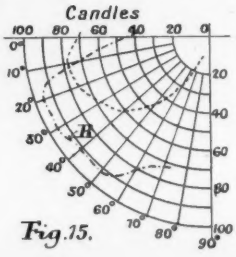


Fig. 15.

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Thermal Radiation.

Having dealt with a few practical aspects of luminous radiation, we may conveniently pass on to the consideration of thermal radiation—*i.e.*, the thermal effect of the radiation.

The subject of thermal radiation is a very important one in regard to the gas-fire, and deserves the most careful consideration from the point of view of its economic production and distribution. A convenient method of exploring the distribution of thermal radiation from a gas-fire is by means of a thermopile and galvanometer, as was, I believe, first suggested and used for this purpose by Mr. J. H. Brearley, of Longwood. This apparatus is used to indicate the thermal effect of the radiation in various directions, just as a photometer is employed to ascertain the distribution of light from a lamp. It is used in connection with the researches carried out under the auspices of the Gas Heating Research Committee of the Institution of Gas Engineers; and the results obtained are, by previous calibration of the thermopile and galvanometer, converted into heat units, which are calculated to a percentage of the total heating value of the gas.

After a somewhat extensive experience with the thermopile, I am convinced that, although it is a useful apparatus for certain purposes on account of its handiness and low thermal capacity, it is not suitable for the commercial evaluation of gas-fires. Rather more than a year ago, I made a form of radiation calorimeter which, so far as I know, has some novel features. Before describing the apparatus, however, it will perhaps be interesting to discuss what is to be measured when evaluating the radiant efficiency of a gas-fire.

It has already been mentioned that thermal radiation behaves in many respects exactly as light; and it may be taken that thermal radiation issues from a fire in every direction in which the incandescent surface can be seen. Hence, to get the total radiation from the fire, it is necessary to ascertain the heat that would fall upon a hemisphere so arranged that its surface intercepts all the radiation. Such a method is correct for certain scientific purposes; but it does not afford an index to the practical value of a fire as ordinarily used. The lines I have pursued are as follows.

Assume a fire standing upon a glazed tile hearth; then the radiation that would fall upon a semi-cylinder of 24 inches radius and $4\frac{1}{2}$ feet high, when so arranged that its diameter is coincident with the surface of the fire, is all that should be placed to the credit of the fire. It will be seen that such a method takes no account whatever of some of the radiation, as, for instance (1) that which passes over the top of the semi-cylinder, and (2) that which is absorbed by the tiles within the 24 inches radius. It can be easily shown that the heat which passes over the semi-cylinder ultimately reaches the ceiling, so that it is of no great value for warming the room. Fortunately, it is a small quantity. The heat which falls upon the tiled hearth is a very appreciable amount, and is partly available as reflected radiation, which would fall upon the semi-cylinder, and, to that extent, would be placed to the credit of the fire.

Having decided what is to be measured, we may proceed with the methods adopted. It is not convenient to measure the radiation falling upon the semi-cylinder as one quantity; but it is obvious that, if the semi-cylinder is divided into a number of vertical strips, and the heat falling upon each strip measured separately, the separate values can be integrated and the total value found.

Radiation Calorimeter.

The instrument referred to is shown in fig. 16. It was made from my models by Messrs. Alexander Wright and Co., of Westminster, who also incorporated some important mechanical details of their own. The instrument consists of a thin tube of 30 gauge copper, 54 inches high and about 2 in. by $\frac{1}{8}$ in. internal section. The tube is suspended in a frame at the top of a stand, in such a way as to prevent heat passing into it by conduction from the stand. Connections are provided, so that water may be admitted at the bottom and led away at the top into a funnel switch. Thermometers graduated to $\frac{1}{10}$° C. are fitted at the top and bottom, so that the difference of temperature can be easily ascertained. The instrument stands so that one of the broad faces of the flat tube is turned towards the fire. This side is lampblacked to facilitate absorption of the radiation, and the opposite side is polished to minimize radiation therefrom.

The left-hand photograph shows the apparatus in position, with the polished side of the tube facing the camera. It stands upon a quadrant base which has holes spaced 10° apart. Pegs in the tripod foot fit into the holes, so that the apparatus can be quickly placed at the various positions round the fire. The quadrant is reversible, so that it can be used on both right and left hand sides of the fire, and is equivalent therefore to a semicircle. The right-hand photograph gives a front view of the apparatus, with the black face of the tube towards the camera. The funnel switch and thermometers with lenses are also shown. It is readily seen that, when the apparatus is placed at the various points round the fire, the black surface always corresponds with a strip of the imaginary semi-cylinder. The flat tube is bevelled at the edges, to accurately define the area of the heat receiving surface. A polished copper screen is used, about 5 inches wide, and equal in length to the flat calorimeter tube. The purpose of this is to screen the radiation of the fire from the tube.

The instrument, when in use, is first of all placed in position opposite the fire, taking care that the blackened surface of the tube is normal with the line joining it and the centre of the fire.

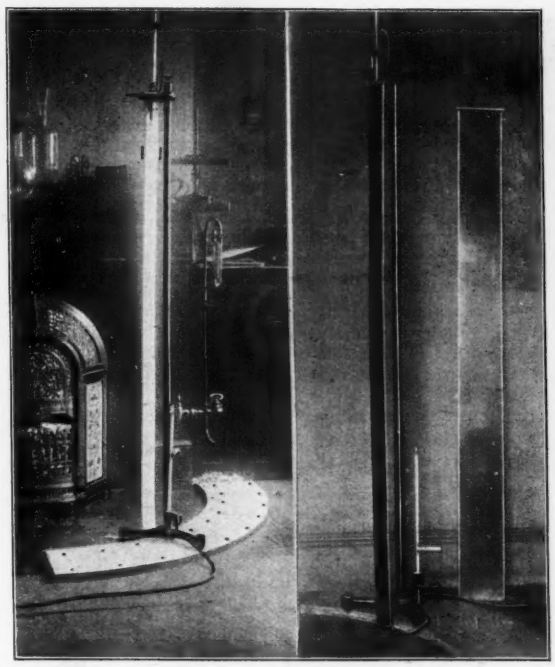


Fig. 16.

This adjustment is provided for in the quadrant stand on which the instrument is mounted. Having adjusted the apparatus, a water current is started and regulated to give a rise of temperature of about 4° or 5° C. When the inlet and outlet temperatures have reached equilibrium, the thermometers are observed, and the speed of the water current noted. The polished copper screen is then placed in front of the tube, about 2 inches from it. This obscures the radiation of the fire from the tube; and after about 2 minutes, the outlet temperature falls to a constant value, when the observations are taken again. The difference between the heat received by the screened and unscreened calorimeter tube, is the radiation which falls upon it at the particular position. These observations are repeated for other positions corresponding with the imaginary semi-cylinder; and from the mean value so obtained, and the relative areas of the imaginary semi-cylinder and the blackened surface of the calorimeter tube, the total radiation value is easily calculated. The separate values obtained for the various positions may be plotted on a polar diagram to show the distribution of the radiation, which is an important characteristic of gas-fires.

The following simple calculations are necessary.

If the calorimeter tube is 54 inches long and 2 inches wide, then—

Surface of calorimeter $= 2 \times 54 = 108$ square inches.

Surface of imaginary semi-cylinder $= 24 \times 3{\cdot}1416 \times 54 = 4072$.

$$\text{Ratio } \frac{\text{Area of semi-cylinder}}{\text{area of calorimeter}} = 37{\cdot}7$$

Therefore the total value in heat units is obtained by multiplying the mean value as given by the calorimeter by 37·7.

Use of the Obscuring Screen.

I was led to adopt what I have called the obscuration method by the following consideration. When instruments of the kind described are exposed to a fire, heat is imparted to the current of water by radiation from the fire and conduction from the surrounding air. The latter is an appreciable and variable quantity, depending upon the temperature of the air, and the speed of the water current. Any measurement made without regard to the conducted heat is therefore of doubtful value. The obscuration method eliminates the conduction error by differentiation. It will be noticed that, if the inlet-water temperature could be relied upon to keep constant, the outlet temperature would be all that need be measured; but I have found it difficult to ensure this condition, and have two thermometers fitted accordingly.

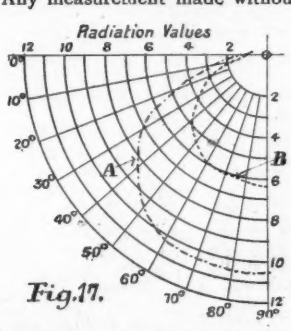


Fig. 17.

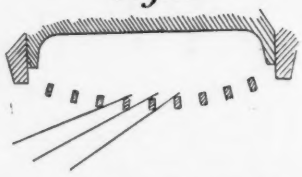
Fig. 17 represents the polar distribution from a particular fire, as measured by the radiation calorimeter and by the thermopile. A is the thermopile curve, and B the calorimeter curve. The proportion of the radiation in the various directions as measured by the calorimeter does not coincide with the values given by the thermopile. This might have been expected, because the thermopile intercepts a much smaller quantity of the radiation than the calorimeter. The thermopile readings were taken in a plane level with the centre of the fire. The total radiation in this case was 149 B.Th.U. per cubic foot of gas consumed.

Of course, in addition to the radiation, a fire gives up a large quantity of heat by convection; and probably the most satisfactory form of heating is by a suitable combination of radiation and convection.

Design of Fire Fronts.

A very conspicuous development in the gas-fire during the past two seasons is the partial or complete removal of the grid-front. This is a material advantage from the point of view of radiant efficiency; and it may not be uninteresting to see how it takes place. Fig. 18 represents a cross-section of a grid-front. The

Fig. 18.



obstruction of the radiant heat in the normal direction due to the grid-front may be roughly calculated by comparing the frontal area of the bars with the total area of the front. If, however, oblique lines be drawn as in fig. 18, it is clear that the radiation in these directions is entirely obstructed by the bars. The removal of the bars therefore results in a larger increase of radiation in the oblique direction than towards the front.

Grillers.

Another practical aspect of thermal radiation is the use of the gas-griller. The toasting or grilling power of the cooker is dependent on radiation from the heated fret. As bearing on this, fig. 19 is interesting. It was obtained by means of a simple form of calorimeter, consisting of a series of copper tubes so

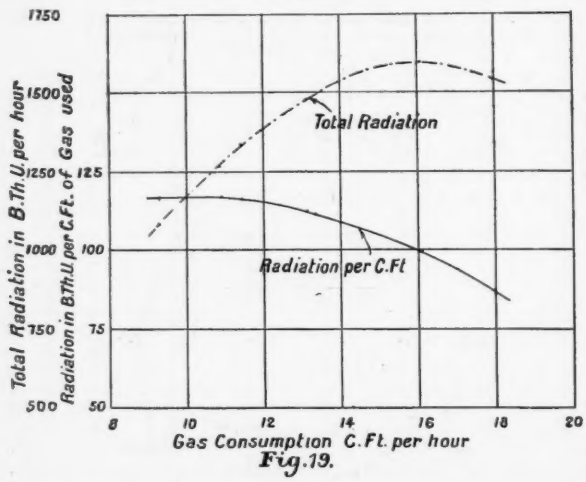


Fig. 19.

arranged as to form a flat surface about 6 in. by 9 in., or 54 square inches. This surface is lamp-blacked. Connections are provided so that water can be passed through the tubes in series; and the whole is supported in a stand which permits of the calorimeter being placed at a given distance from the griller-fret. Thermometers are fitted to show the inlet and outlet temperatures of the water current.

From a knowledge of the velocity of the water current and the increase of temperature between the inlet and outlet, the heat imparted to the water can be calculated; and, if the consumption of gas is known, the radiant efficiency of the griller can be ascertained.

This apparatus was originally made with some other special calorimetric appliances for the use of my students at the Westminster Technical Institute; but it also serves very well indeed for general work. The diagram shows that, with the particular griller used, the total radiation increases with increasing consumption to a maximum at about 16 cubic feet per hour, above which it falls off. The efficiency curve shows that the radiation per cubic foot of gas is a maximum when the consumption is between 9 and 12 cubic feet per hour. It is very useful and interesting to compare grillers and griller fittings in this way. I need hardly say that the waste heat from the griller is available for heating kettles, &c.

I have endeavoured in the short time at my disposal to indicate to you the importance of the study of radiation in connection with gas lighting and heating. The subject is no less interesting than important; and if I have done anything to make the matter clear to you, the object of my paper will have been achieved.

Discussion.

The President remarked that the author had dealt with his subject in a masterly way. The question of radiation was one of increasing importance, with regard to street-lighting especially. In the scientific lighting of the surfaces of roadways, it should be their object, by means of adequate reflectors, to gather all the rays above the mean hemispherical line and diffuse them in the direction in which they were most needed. In this, the author had afforded them a great deal of help; and the paper would be a most useful one. As to gas-fires, seeing how they wished to push them, it would be of much assistance to be able to tell, with the aid of such an instrument as Mr. Clark had devised, the actual amount of radiant heat that could be secured from different types of fires.

Mr. K. Sproxton (Hornsey) asked whether the taking of a height of $4\frac{1}{2}$ feet for the calorimeter test was quite an arbitrary thing. It seemed to him that the author was rather sweeping in his announcement that all heat above $4\frac{1}{2}$ feet was entirely lost. One diagram that puzzled him immensely was that of the distribution of light within the sphere. It seemed to him that the diagram was—well, he would not say misleading; but at any rate the author depreciated the light falling in the downward direction, showing that that in the horizontal direction was very much stronger. He (the speaker) had always understood that the light distributed from a central point within a sphere would fall practically equally in all directions, and that every part of the sphere would be equally illuminated. In any case, it seemed to him that to draw a horizontal line was very arbitrary. Why should there be any horizontal line?

Mr. W. T. Hogg (Mitcham) took it that the diagram referring to radiation from the fire just showed the alteration of the intensity of heat over angles in the horizontal plane. Had the author thought it desirable at all to measure the variation in angles over the vertical plane, similar to the light rays?

Mr. T. F. Canning (Ilford) inquired whether Mr. Clark could give them any idea of the amount of heat that was radiated from a gas-fire, and also whether he could state the exact amount of heat that would be lost from his calorimeter during action. The apparatus was very ingenious; but it seemed to him that there must be an appreciable amount of heat lost over the large surface exposed away from the fire.

Mr. F. Ainsworth (Ilford) thought the paper must prove of great service to the members. There were always some things they were not altogether sure of; and what Mr. Clark had written would help them to decide upon the course to adopt in certain circumstances. On the subject of reflectors, what kind of burners did he find the most economical and best to use for shop front lighting, upright or inverted? No doubt, for the lighting of shop windows reflectors must be a great help in showing off the goods. As to fires, Mr. Clark had convinced him still further that the fixing of these in an ordinary grate was a mistake, on account of the metal that they had to contend with. He himself had often condemned this form of heating rooms. What he would like to see was a fire constructed specially to put in front of the ordinary grate, and which would stand out a little; and it should be made in such a form that it could be regulated. They wanted a large outlet, so that they could meet all the objections that could be put to them. Perhaps Mr. Clark could tell them the best pressure for a gas-fire. Personally, he had secured very good results with a pressure of 12-10ths. Would Mr. Clark tell them the kind of griller he used for his tests?

Mr. E. W. Eldred (Gaslight and Coke Company) remarked that comparing a parabolic shade and an ordinary diagonal half-opal globe, the former gave a very dead appearance to a shop as one approached it; and for this reason he did not like it. Of course, he took the circumstances of the shop into consideration; but he always when possible recommended people to have the ordinary diagonal half-opal globe. He did not think, judging from the look of shop windows, that there was very much difference between the amount of light reflected from the half-opal and that from the parabolic; certainly the appearance on approach was greatly in favour of the half-opal globe.

Mr. F. H. Wedd had two questions he would like to ask. The first was whether raising the incandescent portion of the fire-front would make it necessary for the author to use a higher cylinder, and whether he would not get more heating effect from the fire-front if it were raised a little. The other point was whether, taking an argand burner and an incandescent mantle, he could give any idea as to which furnished the greater radiation per cubic foot of gas.

Mr. J. Hewett (South Metropolitan Gas Company) remarked that Mr. Clark had dealt with the subject of radiation in such a manner that everyone could understand what he was talking about. As to the instrument which had been shown, he would like to ask whether it was really a laboratory instrument, or whether it could be used on a consumer's premises. Of course, the subject of water would come in, as it was not very easy to fix up a water supply arrangement on the premises of a consumer. Had the author considered whether he could design an apparatus to attain

the same end, in which no water would be used? Then the need of having two thermometers at a considerable distance from each other rendered the readings not quite simultaneous.

The PRESIDENT said they were fortunate in having Mr. T. S. Lacey and Mr. T. V. Fenn, both of the Gaslight and Coke Company, with them that evening; and he hoped these gentlemen would contribute to the discussion.

Mr. T. V. FENN said allusion had been made to fires fitted in grates. He had in mind the "Blenheim" pattern, which was an excellent one, and one of the best on the market. There were thousands of these fixed; and he never recollected having a complaint that there were products of combustion passing into the room. With regard to the consumption and pressure of a fire, this could well be manipulated by a governor; but unfortunately governors were rather unwieldy, and it was difficult to place them so that they would be hidden from sight. In many cases, when they wanted to regulate the consumption, they fixed up a small regulator; and it was often found that this brought the consumption down to the amount the fire should burn, and gave satisfaction to the customer. He quite agreed that the bars of the modern grate did take away a lot of heat units. He had a case in his own office, where there was a fire with a set of rather thick vertical bars. These were removed, and thin bars put in; and the difference in the heating properties of the stove were most marked. With reference to grillers, there was, of course, a wide difference in the efficiency of different forms.

Mr. T. S. LACEY remarked that Mr. Clark was a few years ago engaged with him in making certain researches in lighting and the value of the incandescent burner with gases of different calorific powers; and he knew that he was a painstaking investigator, and that any work he undertook would be done thoroughly. The word "research" had been used very frequently lately; and perhaps a somewhat exaggerated value had been given to one form of research, and that was purely scientific research. As far as they were concerned, research on purely abstract questions of science was out of place; but it did not follow that research was not absolutely necessary, and research in the particular direction in which Mr. Clark had undertaken it in his paper was most vital to them. The kind of research that was really useful to them was research that was sufficiently accurate for their purposes. They did not want to determine the length of different coloured waves of light, &c.; but they did want to know, when they were burning gas in a fire, whether they were getting 30, 40, or 50 per cent. of the available heat in the room. It was easy to say this could be ascertained in this way or that. All that was necessary was to put the gas-fire inside a calorimeter, and the thing was done. The only requisite step was to make the calorimeter; and Mr. Clark had done so. He had not before seen one anything like so practical as this instrument. It did what was required of it. The tube would absorb, he understood, the whole of the radiant heat.

Mr. CLARK: We must assume that, at any rate for the present.

Mr. LACEY (continuing) said they might perhaps take it that it would absorb about 95 per cent. If they could put this tube right round the fire, all the heat that came out as radiant heat would pass into the calorimeter, and go to raise the temperature of the water. The principle of the thing was extremely simple. The only point open to discussion was the accuracy of the instrument. The most important thing about the research was that it should be accurate within practical limits; and he felt perfectly certain this instrument was so. As to the particular height of the tube, he thought Mr. Clark had adopted a very sensible course. He had made it high enough for all practical purposes. They had there an instrument which he considered was remarkably useful and practical; and such an appliance was worth a great deal of money to gas companies. It was the kind of thing that constituted their bread and butter. The application of an instrument of this character was of the very greatest importance. Much thought and ability had had to be exercised in devising it. The way in which the problem had been regarded had been a wonderfully clear-sighted one; and it had been tackled in a very sensible manner. There were no complications around the apparatus. In fact, the whole thing was so simple and so unpretentious that Mr. Clark was not likely when showing it to get anything near the amount of credit due to him for the ingenuity displayed in devising it. He heartily congraulated him on having invented it. The manipulation of the instrument could not require any great refinement. All that was needed was conscientious reading of the thermometers, and so on. He did not see any difficulty in using the instrument anywhere—provided people did not object to them doing so. As to the tiled floor, he thought it was quite proper to have used this, as many people had them. The instrument would enable them easily to ascertain the behaviour of different stoves. With regard to the portion of the paper on light, this was a question of immense importance. For public illumination, people did not care how many cubic feet of gas they were going to be supplied with; but they wanted to know how many thousand candle power they were to have, and where it was to be put. What they had to do was to compete with other people in producing a certain illuminating effect in the streets. The distribution of light was a most interesting study. The paper would well repay careful reading; and he had great hopes that in future they would hear more of the performances of the instrument to which Mr. Clark had drawn their attention.

Mr. L. F. TOOTH (Stepney), in proposing a very hearty vote of thanks to the author, remarked on the full way in which the subject of reflection had been dealt with. The matter of the radiation of gas-fires was also most important; and there was need for a great deal of research work in this direction. The question of fuel had not been touched on. As they knew, the single row fuel with the chimney effect made the gas-fire more efficient; and with the aid of this instrument for the measurement of the radiant heat, he looked forward to getting it absolutely perfect.

Mr. CANNING seconded the vote, which was heartily accorded.

Mr. CLARK said that as time was getting on he would prefer to leave over the reply to the discussion until the May meeting. He was greatly obliged to them for their vote of thanks, and would like to take the opportunity of saying that he was indebted in a very large measure to his chief, Mr. F. W. Goodenough, Chief Inspector of the Gaslight and Coke Company, for the facilities for placing his paper before the members. Mr. Goodenough, he said, always took a keen and kindly interest in work of this kind.

AN ELECTRIC GAS-METER.

Some Further Details of Its Construction.

In the "JOURNAL" for Feb. 15, we reproduced from the pages of an electrical contemporary some particulars of a meter that was described before the American Society of Mechanical Engineers in a paper read by the patentee, Professor Carl C. Thomas, of the Department of Steam and Gas Engineering of the University of Wisconsin.

When sending a copy of his paper (in response to a request addressed to him), Professor Thomas enclosed a print of an addition which he made to the paper, giving the theory of the meter; and he also sent a photograph (fig. 1) showing the general scheme of the meter as it is being built at the present time. He adds: "The Cutler-Hammer Manufacturing Company in Milwaukee are making the meters for commercial work. The meters are being adapted to the measurement of coke-oven gas, blast-furnace gas, producer gas, illuminating gas, and air. In some cases the gas is under high pressure. The meters are at the present time being so arranged that the record of gas-flow is taken in the gas office, where it can be conveniently read without going out into the works. In some cases, the meter is equipped with autographic recording apparatus; and in other cases the principle of the integrating watt-meter is employed."

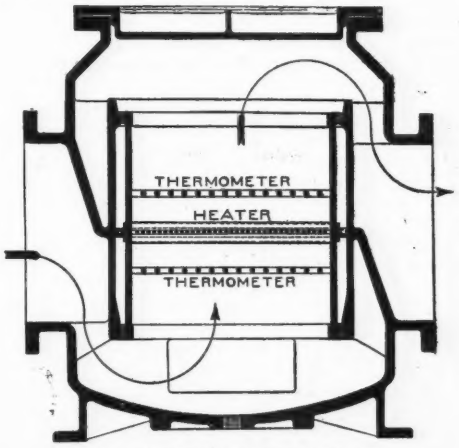


Fig 1.—The General Scheme of the Meter.

The chief paper by Professor Thomas starts by pointing out the six characteristics of the meter he invented—see *ante*, p. 440; and it then proceeds: The meter consists of two parts—first, the measuring element A (figs. 2 and 3), through which all the gas passes when the meter is in operation; and second, a bye-pass, B (fig. 2), so arranged that the meter can be readily cut off from the gas-main by the operation of the valves C, when it is desired either to operate without the meter for the purpose of inspecting or cleaning-out, or to cut the meter out altogether for any reason. In certain classes of gas plant, rolling valves, such as are shown at C, have been found to give trouble, while in other classes of work they are satisfactory. The gate-valves customarily used in gas-work, can be substituted for rolling-valves as occasion requires, and the bye-pass can be made up of ordinary pipe and fittings instead of being part of the meter.

The meter consists of an electric heater D (figs. 2 and 3), formed of suitable resistance material disposed across the gas passage in such a way as to impart heat uniformly and at a regular rate to the gas passing through the meter. The temperature of the gas is thus raised from that at its entrance to some higher exit temperature; and the rise of temperature is measured and autographically recorded by means of the two electrical resistance thermometers E on the two sides of the heater.

These thermometers consist of wire wound upon vertical tubes

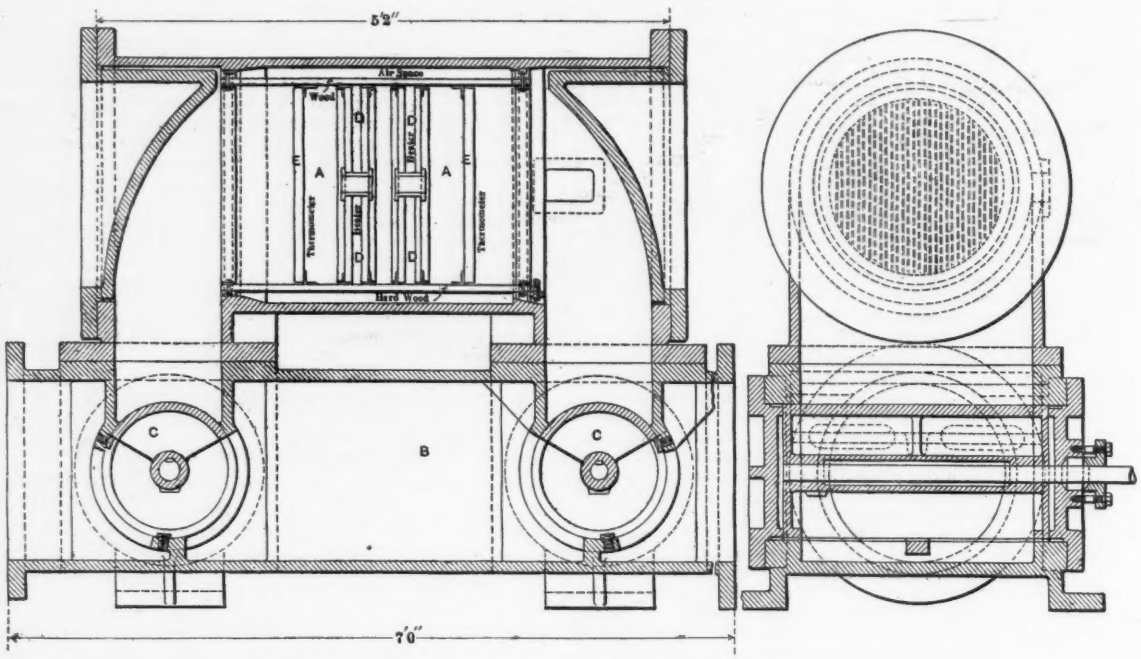


Fig. 2.—Longitudinal and Cross Sections of the Thomas Electric Gas-Meter.

so disposed as to come in contact with all the gas passing through the meter, thereby indicating the average temperature over the cross section of the gas passage. The fifteen tubes shown at the right of fig. 2, and also in fig. 3, extending in a vertical direction over the cross-section of the meter, support the resistance wire of the thermometers so as afford a rugged construction. These thermometers are connected to a recorder which draws a line on a chart and thus indicates the difference of temperature between the two thermometers.

A typical diagram is shown in fig. 4. This diagram represents a gas flow of from 90,200 to 85,000 cubic feet per hour, taken during a portion of the day when the fluctuation in flow is small, but nevertheless continuous. Every small fluctuation in the quantity of flow is recorded on the diagram.

The diagram in fig. 5 was made during a period in which the flow varied extensively; the smallest amount recorded being about 17,000 cubic feet per hour, increasing to 45,000, then to 62,000, to 75,000, the record ending at a flow of about 32,000 cubic feet per hour.

The record in fig. 4 was made with a temperature difference of about 4° Fahr. between the two thermometers, and an energy input of approximately 2 kw. The energy input when the record in fig. 5 was made was approximately 1·15 kw. Fig. 4 is a typical record for a meter of normal capacity of 100,000 cubic feet per hour, with an electric input of 2 kw.

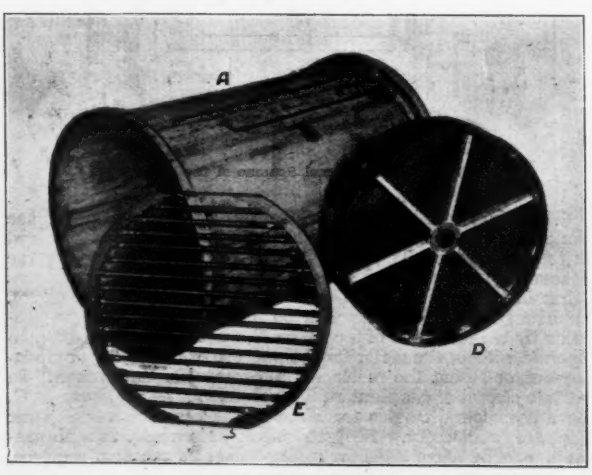


Fig. 3.—Showing Construction of Heater and Thermometers.

The principle underlying the measurement of gas by this means is as follows: If gas is flowing through the heater at a given uniform and constant rate, and if heat is being supplied electrically, and imparted to the gas at a constant rate, a certain definite rise of temperature will be produced in the gas during its passage between the two thermometers and through the heater; and this constant difference of temperature will be maintained so long as the amount of gas passing per unit of time is constant. But if the quantity of gas passing per unit of time diminishes, the heat supplied at the same constant rate as before will raise the temperature of the gas by a greater amount than was the case when a larger quantity of gas was flowing and absorbing the energy liberated by the heater. Conversely, if the rate of flow increases, the energy being supplied to the heater and delivered to the gas will not be able to raise the temperature by as great an amount as when the rate of flow was less. The temperature difference produced by a known input of electrical energy thus forms a measure of the quantity of gas flowing through the meter.

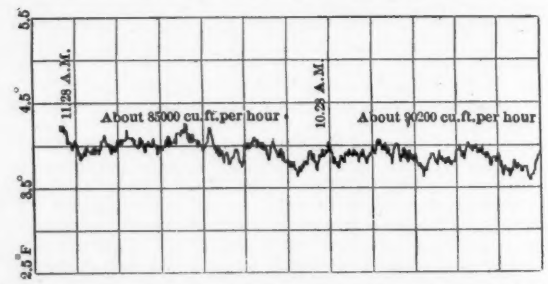


Fig. 4.—Autograph Record Showing Gas Flow of about 85,000 Cubic Feet per Hour.

NOTE.—This diagram was taken under approximately steady conditions of flow during the regular operation of one of the plants of the Milwaukee Gaslight Company. The paper in this case was travelling at a rate of 3 inches per hour. The recorder can be set for any one of the three speeds of paper—3, 6, or 12 inches per hour. The higher speeds are desirable, as they smooth out the curve of temperature differences. The scale of temperature differences can also be greatly enlarged if desired.

The meter may be operated in either one of two ways, of which the first is as follows: The difference of temperature between the inlet and the outlet is kept constant; and the watts required to maintain this constant difference of temperature vary directly as the weight of flow. The watts input thus forms the measure of the weight of flow of air or gas; the watts being measured by a recording wattmeter, or in some cases by an integrating wattmeter. The fixed difference of temperature (about 5° Fahr.) is maintained by the action of a device made upon the same principle as the well-known autographic temperature recorders used in connection with resistance thermometers, but without the autographic part.

The mechanism which actuates the pen carriage in the autographic recorder is so arranged that when the carriage tends to depart from the straight-line path indicating a constant difference of temperature, it automatically cuts in and out the resistance necessary in order to maintain the fixed difference of temperature. This variation of energy input is accomplished by a small motor-controlled rheostat mounted on the switchboard. Thus as the rate of flow of gas is increased the temperature difference tends to decrease; and at once additional energy is introduced, sufficient to heat the increased weight of gas so as to maintain the constant temperature difference. This method of operation is advantageous because it does not require the maintenance of a

constant voltage on the line supplying the energy for heating the gas. The accuracy is thus independent of the small fluctuations in voltage generally found on electric supply circuits.

The second method of operation involves the use of the autographic temperature recorder, including the graphical part, the diagram from which, representing the variation of difference of temperature with constant energy input, gives the measure of the quantity of gas passing the meter. That is, the electrical resistance of the meter remains constant, and the meter is supplied with current at constant voltage, which results in constant energy dissipation in the meter. The difference of temperature between the inlet and the outlet then rises and falls according to the decrease or increase, respectively, of the rate of flow of gas.

The first method of operation mentioned is superior to the second method, inasmuch as the first is independent of any change which might take place in the electrical resistance of the material composing the heater. Operation by the second method requires that constant voltage be maintained across the line, and that the electrical resistance of the heater shall remain constant, or else that both watts input and temperature difference shall be recorded. In the experimental work of developing the meters, it has been found convenient to use this second and more cumbrous method; but in meters at present under construction, the first-mentioned method has been adopted—thus avoiding the necessity for either constant voltage or constant resistance, and resulting in simpler apparatus throughout. A record of the watts input is, by the method now used, all that is required for determining the flow of gas through the meter. The meters can be arranged to operate with either direct or alternating current; and the controlling device can be arranged to work with any desired voltage.

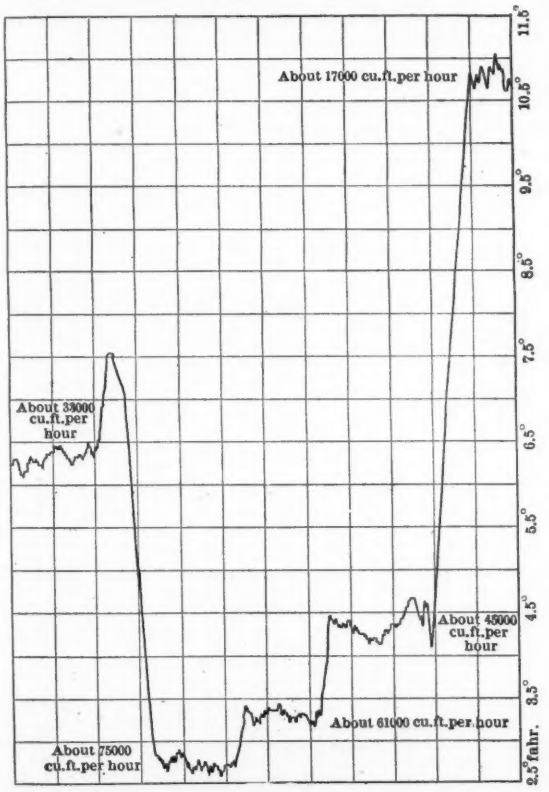


Fig. 5.

The electric meter at Milwaukee is used for measuring all the gas which was formerly passed through a large wet meter, and is of sufficient capacity to enable it to measure about three times the amount of gas for which the wet meter is suited. The electric meter was placed in this position between a 100,000 cubic feet gasholder and the large station wet meter, for the purpose of calibrating the electric meter and comparing the results, based upon the rate of drop of the gasholder, with the readings of the wet meter. The curve obtained from the autographic recorder was thus interpreted by means of the calibration carried on in connection with the gasholder, the wet meter, and a meter prover of the largest size made. It was found that the wet meter used in this case was exceedingly accurate. It had been carefully put in order and calibrated before the tests, and when operated at loads within its capacity the readings were entirely reliable. The best evidence of this is given by the results used in plotting fig. 6.

The specific heat of a given kind of gas appears to be very nearly constant, since those constituents which vary from time to time are not those which appreciably affect the value of the specific heat. But it is desirable to calibrate the meters with a gas having the same specific heat as that which it is intended to measure in a particular case. The specific heat of illuminating gas is very closely 0·020 per cubic foot at atmospheric pressure, as shown by fig. 6 and also by the following calculation based upon a fairly

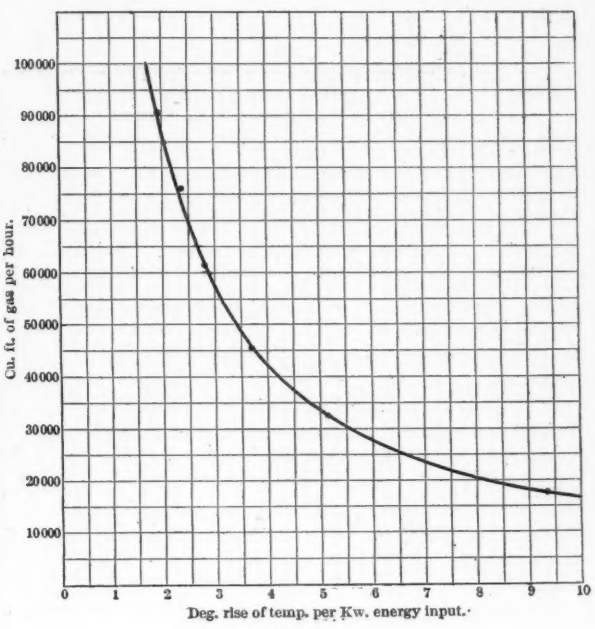


Fig. 6.

typical analysis. Such variation as commonly occurs in the relative amounts of the various constituents does not materially affect the specific heat.

	Volume. Cubic Feet.	Weight per Cub. Ft., Lb.	Total Weight. Lb.	Specific Heat per Lb.	Specific Heat per Cub. Ft.
CO_2	0·04	0·11637	0 004658	0·216	0·00100
C_2H_4	0·11	0·0741	0·00815	0·404	0·00329
O_2	0·001	0·08463	0·00085	0·217	0·00023
CO	0·331	0·07407	0·02450	0·245	0·00600
CH_4	0·1761	0·04234	0·00746	0·593	0·00442
H_2	0·303	0·00530	0·00160	3·409	0·00546
N_2	0·0389	0·07429	0·00289	0·244	0·00071
					0·02111

The specific heat of blast-furnace gas is practically the same as that of atmospheric air; and the same is true in a general way regarding producer gas. Thus, taking the following as an average analysis of blast-furnace gas, the specific heat is found to be 0·0192; while atmospheric air has a specific heat almost identical with this, or approximately 0·0191 per cubic foot. This is to be expected, since producer gas and blast-furnace gas consist principally of nitrogen and carbon monoxide.

	Volume. Cubic Feet.	Weight per Cub. Ft., Lb.	Total Weight. Lb.	Specific Heat per Lb.	Specific Heat per Cub. Ft.
N_2	0·60	0·0743	0·0446	0·244	0·0109
CO	0·24	0·0741	0·0178	0·245	0·0044
CO_2	0·12	0·1164	0·0140	0·216	0·0030
H_2	0·02	0·0053	0·0001	3·409	0·0003
C_2H_4	0·02	0·0741	0·0015	0·404	0·0006
					0·0192

The meters have been calibrated with illuminating gas and with air. A certain amount of water vapour is carried with the gas or air passing the meter. This vapour forms part of the gas or air, and is heated just as are the other constituents. The rise of temperature caused by the heat added in the meter is only a few degrees, and consequently the water vapour does not experience a change of state. The temperature of the metal forming the electric heater rises only 15° or 20° Fahr. above the temperature of the gas. The question of latent heat of vaporization of the water vapour, therefore, does not enter into the considerations underlying measurement of the gas.

While calibration of the meters under actual conditions of service is depended upon to obtain quantitative results, yet these meters are of such a nature that the quantity of gas or air passing through them can be very closely calculated from a knowledge of the energy input and the specific heat of gas or air. This fact—that the quantity of flow can be quite closely calculated, independently of a calibration curve—makes it possible to check the accuracy of the readings obtained.

The development of this meter is a result of experiments which the writer has been making for some years to determine the specific heat of gases by heating them electrically. The performance of a properly constructed heater for this purpose proved to be so entirely regular that it was apparent that the quantity of gas flowing through it could be very accurately measured by the method now used in these meters. The problem is thus the reverse of the problem of determining specific heat by measurement of the electrical energy necessary to heat the gas. It will be seen by reference to fig. 2 that the whole process of heating the gas and of measuring the difference of temperature between inlet and outlet is accomplished in a relatively small space which is well insulated so far as heat losses are concerned, since the

heater and thermometers are contained in a casing made of hard-wood strips and separated from the metallic walls of the meter by an air space.

A typical calibration curve is shown in fig. 6. The curve shows the degrees rise in temperature per kilowatt introduced when any given rate of flow through the meter is taking place. It will be seen that this curve is asymptotic to the co-ordinate axes, because, when an indefinitely great amount of gas is being heated, any finite input of heat will produce only an indefinitely small rise of temperature; and, on the other hand, when the amount of gas becomes indefinitely small, a finite input of heat will cause an indefinitely great rise of temperature. The calibration curves obtained are, therefore, rectangular hyperbolas. The product of weight of gas multiplied by degrees temperature rise per watt introduced is a constant; and this constant, for a given kind of gas, takes the place of a calibration curve and renders it unnecessary to refer to a curve. The constant as shown by fig. 6 is 170,000, showing a specific heat per cubic foot of $\frac{3412}{170} = 0{\cdot}0201$.

The accuracy of these meters is not affected by changes in pressure of the gas or air, since the unit of measurement is that of weight rather than of volume—that is, the meter takes cognizance of the specific gravity, or the amount of "stuff" in a given volume of the gas. Also variation of temperature of the incoming gas does not affect the accuracy, because it is a difference of temperature, rather than a fixed temperature, upon which the measurement depends. The meter can be used for gas or air at either high or low pressure, and at either high or low temperature, provided the materials used in its construction are suited to the conditions.

This method of measuring gas seems especially useful in connection with engines operated by gas from producers, blast furnaces, &c., and in measuring the discharge of gas or air from compressors, because the small and rapid periodic fluctuations of pressure due to the suction of gas-engines or to the discharge from compressors, do not interfere with the steady action of the thermometers. The time-lag of the latter is sufficient to smooth out the curve of temperature variation or of watts input, as the case may be, and true average results are thus indicated.

The temperature difference employed when operating with a constant difference is approximately 5° Fahr. When a curve of temperature difference is employed, the temperature rise is from 4° to 5° Fahr. when the normal maximum amount of gas is flowing. This difference may be increased to 10° or 12° when the rate of flow is greatly diminished; and at 100 per cent. overload the temperature difference is from 2° to 2½°. On the autographic record an inch represents a temperature difference of one degree. The thermometers and recording device are such as to render the records accurate within 1 per cent. The minute fluctuations shown by the curves on fig. 4 and fig. 5 are produced by the constantly varying rate of flow in the gas-mains. These can be "damped out" to any extent desired. The apparatus with which this record was taken was purposely made sensitive to minute fluctuations.

The electrical energy required to operate the meters is approximately 1 kw. per 50,000 cubic feet hourly capacity. The curves shown in fig. 5 represent variations of from 17,000 to 75,000 cubic feet per hour, and were made with an energy input of approximately 1·15 kw. To provide for more gas and still have the record lie conveniently on the paper, it is only necessary to increase the energy input by manipulation of the rheostat hand-wheel on the switchboard.

The meters are so constructed that the heads can be easily removed and an air-blast used for cleaning out the interior, or the entire casing, containing heater and thermometers, can be removed and dipped in gasolene for the purpose of removing tar or other deposit. All parts of the meter are of rugged construction, and are of well-developed materials familiar to engineers. The heater units consist of corrugated strips of resistance ribbon about 1½ inches wide, wound spirally into discs of such diameter as to fit the inside of the wooden casing. The number of these discs depends upon the capacity of the meter. The heater shown in fig. 3 consists of two discs.

After describing a modification of the meter specially adapted for the measurement of steam, the author proceeds: The automatic recording device for the gas-meter is so arranged that in case the flow of gas should be interrupted for any reason the current is automatically cut off at the switchboard. Also if the flow of gas becomes so small in amount that the pen reaches within ½ inch of the edge of the paper, the current is cut out. When the gas has cooled the heater slightly, the current is automatically cut-in again; and if the gas flow is increased, the pen goes back toward the middle of the diagram and operation proceeds normally. If the gas flow continues but does not increase beyond that at which the current was cut-out, the pen will "hunt" back and forth near the edge of the paper. It can be brought back toward the middle of the paper by the introduction of more energy to the meter. The gas-meter is thus fully protected from possible injury due to the complete shutting off of the gas supply.

At the other edge of the paper, representing the maximum flow of gas, the operation is similar to that already described. In order to bring the recording pen upon the range again, the electrical input is increased by manipulation of the hand-wheel on the switchboard. This applies to operation by the second method of operation (described earlier), in which the temperature difference between the two thermometers forms the record of gas-flow. When the first method is employed—that of maintaining constant temperature difference—the meter is also automatically protected by the motor-controlled rheostat, and the range of the instrument is unlimited and it does not require manipulation by hand. It will be seen by reference to fig. 5 that the range of the instrument when operated by the second method of varying temperature difference is very wide, and takes care of extensive fluctuations of gas-flow.

Appendix.

Data relating to the Calibration Curve, Fig. 6.

Time.	Wet Meter Reading.	Cubic Feet Gas per Hour.	Average Temperature Difference Deg. Fahr.	Average Kilowatt Input.	Deg. Temp. Rise per Kilowatt.
A.M.					
10.05	90,148·0				
10.10					
10.15	90,177·5				
10.20	90,192·0	17,350	10·7	1·153	9·30
10.25	90,206·0				
10.30	90,220·5				
10.50	90,396·0				
10.55					
11.00	90,470·0				
11.05	90,509·0	45,200	4·25	1·150	3·69
11.10	90,546·0				
11.20	90,644·0				
11.25	90,695·0	61,200	3·25	1·160	2·80
11.30	90,746·0				
11·40	90,884·0				
11.45	90,947·0	75,600	2·70	1·160	2·32
11·50	91,010·0				
P.M.					
12.05	91,098·0				
12.10	91,125·5				
12.15	91,152·7	32,640	6·25	1·22	5·12
12.20	91,180·0				
12.25	91,206·8				
A.M.					
9.30	91,418·2				
9.35	91,493·4	90,240	3·90	2·05	1·90
9.40	91,568·8				
9.45	91,643·8				
10.00	91,857·1				
10.15	92,074·0				
10.30	92,291·7				
10.45	92,506·2	84,960	4·10	2·05	2·00
11.00	92,717·5				
11·15	92,925·4				
11.30	93,131·0				

THE SUPPLEMENTARY PAPER.

Theory of the Meter and Method of Obtaining Standard Results.

The figures given in the paper can be reduced to standard conditions of temperature and pressure, and the meter readings can be autographically recorded directly in "standard cubic feet" of gas or air. Let

G = cubic feet of gas per hour
E = energy in kilowatts

Then B.T.U. per hour = 3412 E

T = temperature difference, degrees Fahr.
S = specific heat per cubic foot

Then G S T = heat energy equivalent to E, or G S T = 3412 E.

$\frac{G\,T}{E} = \frac{3412}{S}$ = a constant K which depends upon the specific heat of the gas.

Since the temperature difference T is kept constant, it follows that $\frac{K}{T}$ is constant. Let $\frac{K}{T} = C$. Then $G = \frac{K\,E}{T} = C\,E$.

It is now proposed to show, by reference to the gas and the air curves in fig. 7, that if the specific heat of gas made under given conditions be calculated from the customary chemical analysis and the specific heat of constituents, then this specific heat may be used for determining the constant C. From the gas curve (fig. 7), which was made with illuminating gas at an average temperature of 50° Fahr., and under an average absolute pressure of 6 inches of water and 29·8 inches of mercury,

$$K = 170{,}000 = \frac{3412}{S}$$

Therefore for the condition of the gas when the tests were made the specific heat per cubic foot $= S\,\frac{3412}{170{,}000} = 0{\cdot}0201$. If this be reduced to standard conditions of 32° Fahr. and 29·9 inches mercury, then S = 0·021, which is to be compared with the calculated specific heat, giving S = 0·0211. If the standard conditions are taken as 62° Fahr. and 29·9 inches mercury, the specific heat becomes 0·0198, and the constant becomes

$$K = \frac{3412}{0{\cdot}0198} = 172{,}500, \text{ nearly.}$$

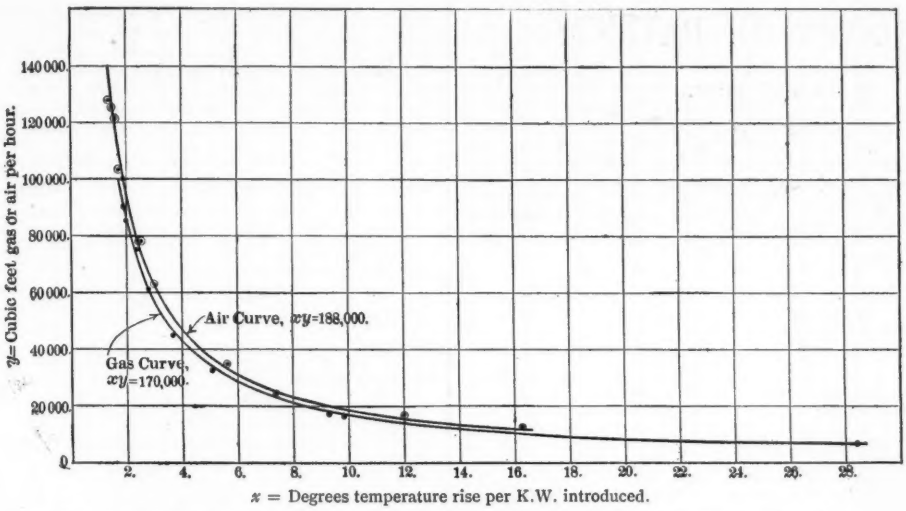


Fig. 7.—Showing Degrees Temperature Rise per kw. for Different Rates of Flow of Gas and Air.

If the temperature difference is kept constant at 5° Fahr., then $\frac{K}{T} = \frac{172,500}{5} = 3450 = C$, or $G = 3450\ E$.

The cross-section paper on the recording wattmeter is ruled so that 3450 E is read directly, instead of the watts E. The record is thus read directly in cubic feet of gas. The regular records of chemical analysis of the gas should be referred to from time to time in order to ascertain what percentage variation takes place in specific heat. It appears, as stated previously, that the elements which vary during the operation of a gas plant are not those whose variation would produce serious variation in specific heat. The variation that does take place is apparently well within the limits of accuracy practicable, or generally considered necessary in the operation of gas plants. By taking frequent chemical analyses, the error can be reduced so as to be quite negligible.

The conditions during the air tests were as follows: Barometer, 29·75; pressure, 6·5 inches water; average temperature of air as measured in the wet meter, 60° Fahr. From the air curve obtained under these conditions (fig. 7)

$$K = 188,000, \text{ and } S = \frac{3412}{188,000} = 0{\cdot}0181.$$

Reducing this to standard conditions of 32° and 29·9 inches mercury, S = 0·0191. This is to be compared with the accepted specific heat of air under these conditions, or 0·0192 B.Th.U. per cubic foot. This provides perhaps the best evidence that could be obtained as to the accuracy of these tests, since the specific heat of air is well known at the conditions under which the tests were made. A more commonly familiar figure for specific heat of air is obtained by multiplying 0·0192 by the number of cubic feet of air per pound under the above conditions, or 12·38. The result is 0·2377 B.Th.U. per lb. per degree; and this is to be compared with 0·0191 × 12·38 as given by the meter, or 0·2365.

The constant K for air at 32° and 29·9 inches is therefore

$$\frac{3412}{0{\cdot}0191} = 178,630$$

And reducing this to 62° instead of 32°.

$$= K\left(1 - \frac{30}{493}\right) \times 178,630 = 189,500 \text{ nearly}$$

If $T = 5°$, $\frac{K}{T} = 3790$.

The error involved in calling this constant 3800 is less than ¼ of 1 per cent. and well within the limits of accuracy possible under the circumstances. The standard cubic feet of air passing the meter are therefore $G = 3800\ E$; and the autographic records are arranged to read accordingly, in standard cubic feet of air per hour.

The development of a new device requires consideration of a large number of questions arising out of the conditions of service proposed. The question of specific heat has been considered in the preceding paragraphs. The degree of success which has been attained with this meter in accurately measuring specific heat is due principally to an extensive experience in this particular class of work, which has served to point out the way to make an electrical heater in which heat losses are negligibly small. The arrangement of the meter is such that the heat given off can go into the gas only; and it necessarily all goes into the gas, with the exception of a negligibly small loss which it is not worth while to minimize further. That the gas receives all the heat, excepting this negligibly small loss, is true whether or not the heating material has collected deposit of some kind. So long as the gas can get through the heater, its temperature is raised proportionately to the heat supplied.

The question of the presence of a small amount of water vapour, as part of the gas, has so far not introduced any complications. It is conceivable that if the gas carried a large percentage of water, the operation of the meter would be interfered with; but so would the operation of a gas-engine or a burner. The meter can apparently measure accurately any gas that can be used by a gas-engine. The absence of moving parts in the meter gives it an advantage over the engine, and dust can be to a considerable extent deposited before entrance of the gas to the meter. The heating element and thermometers can be cleaned by dipping in gasolene, without damaging them.

Referring to the conditions for gas or air existing during the tests—of approximately 60° Fahr., 29·8 inches mercury, and 6 inches water pressure—the correction for water vapour introduces a change in the results of less than one-half of one per cent., and was therefore omitted. At other pressures and temperatures the correction for water vapour can be easily made by reference to the charts commonly used in gas-works. An interesting confirmation of one statement appeared during the tests, in that the most minute addition of electrical energy caused an immediate rise of temperature of the gas or air. This was repeatedly tried with great care, and always with the same result.

Meters at present under construction are being made with the axis of the cylinder vertical, with a view to greater convenience of access and in making connections. The first large meter of this type to be installed was put in the works of the Milwaukee Gaslight Company.

North of England Gas Managers' Association.—The sixty-sixth half-yearly meeting of the Association will be held in the Lecture Theatre of the Subscription Library, Sunderland, on Saturday, the 7th prox., under the presidency of Mr. T. H. Duxbury. We learn from the *agenda* issued by the Hon. Secretary (Mr. Herbert Lees, of Hexham) that the business will include the consideration of a report on the formation of a Special Purposes Section, to deal with such matters relating to the interests of the gas industry as shall be deemed desirable by the members, as suggested by the President in his address on the last occasion. The other matters will be the presentation of the Scrutineers' report on the election of officers, and the fixing of the place for holding the next meeting. At the close of the business, the members will visit the Ayres Quay Gas-Works, to inspect the installation of Dessau vertical retorts (the first in England) described and illustrated in the "JOURNAL" for July 6 last year; and in the afternoon they will dine together at the Palatine Hotel.

Societe Technique du Gaz.—Notices have been sent by M. Godinet, the President, to members of this Society, announcing the provisional programme of this year's meeting. It will be held in Paris from Monday, June 20, to Thursday, June 23; and the members will assemble, as usual, in the hall of the Société des Ingénieurs Civils de France. The first day's proceedings will, as is customary, be taken up with the ordinary business of the Society, the election of members, the reading of reports, and the like, including the distribution of medals and awards. The mornings of the two following days will be devoted to the technical papers to be read; while on the last day, a discussion will take place on three selected subjects—Different kinds of furnaces, heating with tar, and quenching coke. Two visits are on the programme. One is to the Gennevilliers Gas-Works, and the other to the Landy works of the Paris Gas Company. A special feature of this year's meeting will be the excursion to Brussels, on the occasion of the Exhibition there, to see its Gas Section. This visit will extend from the Thursday, June 23, to the following Saturday; and opportunity will be given to view the bench of vertical retorts at the Forest Gas-Works. Altogether, an attractive programme and pleasant gathering are assured to our French colleagues.

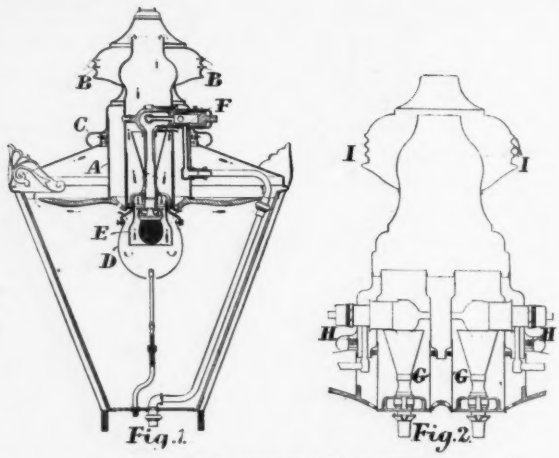
REGISTER OF PATENTS.

Gas-Lamps.

ANDERSON, D., and WORSFOLD, J., of Farringdon Road, E.C.

No. 7486; March 29, 1909.

This invention relates to gas-lamps, particularly for mill and street lighting, and has for its object to construct an incandescent gas-lamp operating on the regenerative principle—the whole of the air passing to the burner being previously heated by passing around a chamber in the form of a pipe in which the products of combustion are passing to the outside of the lamp.



Anderson and Worsfold's Gas-Lamps.

In fig. 1, which is specially suitable for street lighting, the burner is completely enclosed in a lantern with a reflector at the top. In the top of the lantern is a cylindrical piece A, and inside this is a chimney, by which the products of combustion pass up into the space at the top of the lamp, from which they pass downwards and out to the air through the apertures B. The air is admitted circumferentially underneath the flange C, and passes through apertures into the space between the top of the lantern and the reflector. From this space the air which has become heated passes round past the outer edges of the reflector, and so into the lantern. The air then divides—part of it passing inside the inner globe D, and outside the funnel-shaped globe E, and so to the outside of the mantle. The other part of the air passes upwards through apertures in the reflector, and so to the mixing-tube. The gas enters at the bottom of the lantern and passes to the annular space F, in the upper end of the mixing-tube, and thence to the burner nipple. The construction of the burner and nipple, however, forms the subject of a later patent (No. 4293 of 1910*). Surrounding the mixing-tube is a deflecting cone, to throw the hot gases away from the joint in the mixing-tube, and thereby keep it comparatively cool.

The air passing from the inlet C becomes heated before it passes to the lantern, and the air passing out of the lantern and up through the holes in the reflector passes into a chamber immediately surrounding the pipe by which the burnt products are carried off. The air going into this chamber can only pass to the mixing-tube; and the air supply to the mixing-tube therefore becomes strongly heated. Further, as the gas-pipe is situated entirely within the lamp, and the final portion of the pipe is situated in the chamber from which air is taken directly to the mixing-tube, the gas and air will be at practically the same temperature when they arrive at the injector nipple; and the air passing from the lantern into the inner globe, and to the burner, also becomes considerably heated by passing down between the inner globe D and the funnel E, so that only heated air arrives at the burner.

In fig. 2, a pair of burners is used in a single lantern. In this form of the invention, the chimneys G, by which the burnt products pass away, are fitted into apertures in a plate dividing the top part of the lamp from the bottom. The only passages by which air or gases can escape is up the chimney tubes. In this form there is considerable height between the air admission holes H and the outlet to the atmosphere I.

Manufacture of Gas by Continuous Dry Distillation.

ZINDLER, A., of New York.

No. 13,796; June 11, 1909.

The patentee, in his specification, remarks: In the dry distillation of shales and all bituminous matter, by the continuous process in a closed vertical retort through which the matter passes without injection of steam and admission of air, it is usual to take the gases, by suction, from different parts of the retort, but to conduct them collectively to the cooling and purifying apparatus through a main, in which the hot gases are mixed with comparatively cold gases; and "it is well known that the latter are decomposed and deteriorated by the former."

The object of the present invention is to prevent this deterioration—preventing the mingling of the hot and cold gases by using two or more mains connected by separate conduits to hot and cold regions of the retort and taking the gases from the hot and cold regions separately through the mains to cooling and purifying appliances by which they are separately treated.

The specification (which is not illustrated) concludes: "The process of distillation is a continuous and uniform process, in so far as it takes place in a single retort-chamber, through which the material passes uniformly and uninterruptedly. Except as regards the normal differences of temperature, there is no difference in the treatment of the material at different parts of the retorts. I am aware that it has heretofore been proposed to take gases from different zones of a blast-furnace or open-grate retort and separately cool and purify the same—the object being to obtain by this means gases of different qualities."

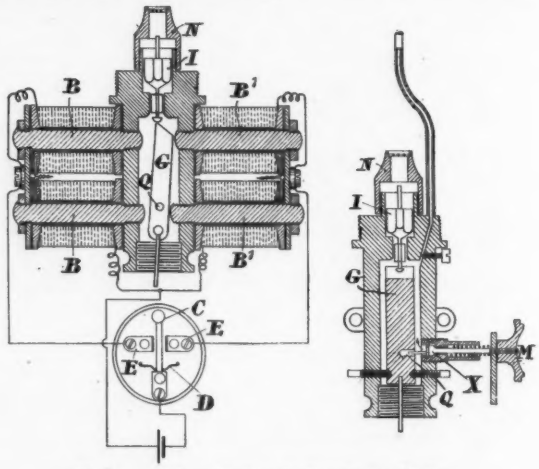
* See next page.

Valves for Gas-Burners.

KOCKEN, E., and MEETEREN, B. T. A. W. van, of Arnhem, Holland.

No. 16,161; July 10, 1909.

This invention relates to a gas-burner valve, which, when the burner is provided with a continually burning flame, can be adapted to be operated by an electric switch.



Kocken and Van Meeteren's Gas-Burner Valves.

The burner in the first arrangement shown is provided with a drop valve I adapted to be operated by a lever G pivoted underneath the valve, and having a bevelled top edge controlling the valve, which it raises or allows to drop through being rocked on its pivot. The valve is covered by a hood N. If the lighting and extinguishing is to be effected by an electric switch, the casing of the burner is fitted with two series of electro-magnets B B¹, for which the lever G will serve as armature. The switch lever C is held in central position by a spring D. By turning it over to the contacts E¹, an electric current is induced in the magnets B¹, which then attract the armature G, the bevelled top edge of which raises the valve I and lights the lamp. For extinguishing it, the lever C is passed over to the contact E, which induces a current in the magnets B. The armature G, being attracted by the magnets, releases the valve I, which drops, thereby cutting off the gas.

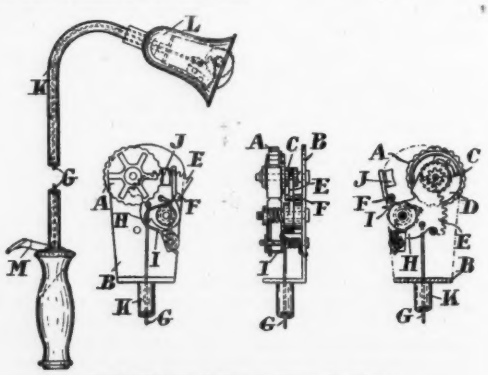
For operating the valve by hand (as in the second arrangement), a grip M is mounted with its spindle in a socket. The tightening of the spindle is effected by a conical enlargement X held against a seating in the socket by a helical spring. A pin eccentrically disposed on the enlargement of the spindle engages a slot Q arranged below the centre of the spindle in the lever, which thus can be rocked by means of the grip M.

Ignition Devices for Gas-Burners.

NAAMLOOZE VENNOOTSCHAP BERGEN OP ZOOMSCHE METAALWAREN-FABRIEK, and MILO, C. J., of Bergen op Zoom, Holland.

No. 16,258; July 12, 1909.

This invention relates to an ignition device of the type in which a rapidly rotating emery disc is adapted to evolve a shower of sparks by contact with a small block of metal.



A Dutch Gas-Lamp Ignition Appliance.

An emery disc A is pivotally mounted on a pin carried by a right-angled plate B. The emery disc is grooved on its circumference; and a small toothed wheel C is pivotally mounted on the same pin. This wheel is preferably integral with a ratchet wheel, the pawl of which is mounted on a flat disc D, firmly connected to the emery disc. A sector or quadrant E is pivotally mounted on a second pin provided on the

plate B. The teeth of this sector or quadrant engage with the toothed wheel C. To limit its stroke in one direction, the sector is pressed against the pin F by a helical spring; the pulling member or cable G being attached to the quadrant or sector E, by means of which the quadrant is turned, and the emery disc is rapidly rotated after the lever has been released. The stroke of the sector is limited in the other direction by a pin.

The mode of operation is as follows: When the quadrant or sector is actuated, the emery disc on the circumference of which the metal block presses will not participate in the turning movement, as the teeth of the ratchet wheel pass freely beneath the pawl. Shortly before the end of the stroke of the quadrant is reached, the projection H collides with the spring I, and presses the block J away from the emery disc. If the pulling cable is released, then the helical spring above pulls the quadrant or sector the other way, thus rapidly rotating the emery disc; while the small block of metal collides with, and hammers upon, the grooved circumference of the disc—evolving a shower of sparks, which leave the emery wheel in a tangential direction.

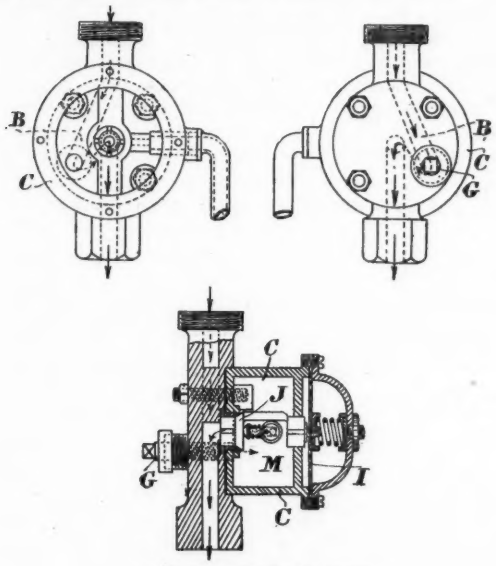
When using the device for lighting lamps, the carrying plate is arranged on a bent pipe K inside a hood or bell L. The pulling member G, which passes through this pipe, is secured to a lever M, which is resiliently mounted on the handle of the appliance.

Automatically Lighting and Extinguishing Gas-Lamps.

EHRICH AND GRAETZ, of Berlin.

No. 19,935; Aug. 31, 1909. Date claimed under International Convention, Sept. 22, 1908.

This invention relates to devices for gas-lamps which switch on the main gas supply and cut out the pilot flame when the pressure of gas in the conduits is increased. The increased pressure then maintains the main gas supply open, and on reduction of the pressure the main gas supply is closed and the pilot flame switched on.



A Graetzin Automatic Lighter.

In the form illustrated, gas entering passes through the inclined passage B, which is bent at right angles to conduct the gas into a casing C. The casting is provided with a side facing to which the casing is attached; the attachment being effected by studs held by nuts. Opposite the opening of the channel B into the casing C, and engaging with a thread in the casting, there is a stop-valve G. The gas is adapted to pass to the lamp from the chamber C and the valve J, connected by a yoke to be operated by a diaphragm I. The valve M, controlled in one direction by a spring and in the other by the motion of the valve J, is arranged to effect the switching of the pilot flame. When a damaged switch is to be removed from a lamp, it is only necessary to close down the stop pin G, and thereby prevent all flow of gas to the casing C, which may then be easily detached by slackening the nuts.

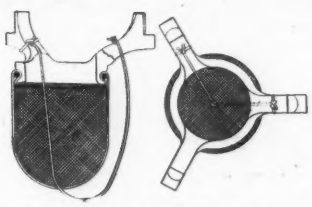
Inverted Incandescent Gas Lighting.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 24,122; Oct. 20, 1909. Date claimed under International Convention, May 15, 1909.

Mantles for inverted incandescent gas lighting are already known (the patentees remark) in which the mantle fastened to a supporting ring is surrounded by a basket; so that if the mantle is damaged from any cause, and detached from the mantle ring, it is still retained so near to the flame as to cause it to maintain at least partial incandescence. (See the patent No. 23,466 of 1904). It has also been sought to attain the same end by either carrying threads through the interior to the apex of the mantle from the mantle-ring (see patent No. 5333 of 1904), or by the application of a piece of fine wire so as to extend over the closed end, and through the sides of the mantle if preferred, and secured at its extremities to the mantle-ring. The former method has the disadvantage that the illuminating power of the mantle is interfered with by the surrounding basket. The second method is of disadvantage in that the plurality of threads passing through the interior of the mantle interferes with the formation of the flame. The third method is disadvantageous because the wire being in close connection with the mantle will not allow of any shrinkage thereof when the mantle is burnt off; so that the mantle is either distorted in shape or broken. The two latter methods are also of disadvantage on account of the difficulty of fitting the threads or wire to mantles without injury to the latter.

To overcome these disadvantages, the patentees propose to make a mantle in which a single strand or thread of incombustible material is secured to the mantle-ring, passes through the mantle, and is then led back to the ring on the exterior.



A German Inverted Mantle Protector.

By the arrangement shown, the mantle is prevented from falling down completely if torn away from the carrying ring, but is held sufficiently within the area of the flame by the thread to produce at least partial incandescence. In its details, the invention is capable of various modifications without affecting the spirit of the same. The thread may be fastened otherwise than shown in the drawings; and instead of a thread, a wire may be used. Instead of being fastened to the lugs of the ring, the thread can be attached to the body of the ring in any convenient manner. If the thread consists of asbestos, it is preferable to make it longer at first, in order to avoid the possible destruction of the mantle by shrinkage of the thread when burnt off.

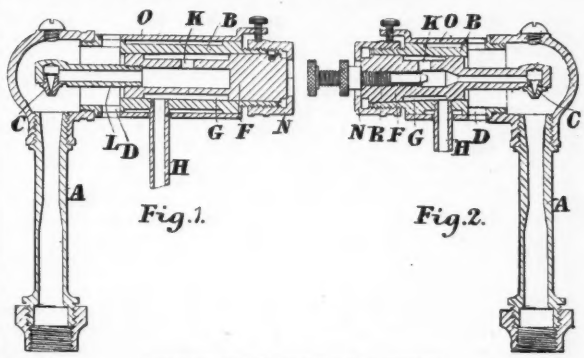
Supply of Combustible in Gas-Lamps.

ANDERSON, D., and WORSFOLD, J., of Farringdon Road, E.C.

No. 4293; April 6, 1910.

This invention has for its object to construct the gas injection means for inverted burners so that ready removal thereof without interfering with the main enclosure or burners of the lamp is facilitated.

The invention consists in a gas-burner having supply means comprising a sleeve to which the gas connection is made provided with a hollow plug slidable therein and a gas-nipple either formed in, or carried by, the hollow plug delivering gas in a transverse direction to the sleeve. It further consists in providing gas and air regulating means in connection with the gas supply means of the type indicated.



Anderson and Worsfold's Gas-Nipples.

Fig. 1 is a section of a gas-burner provided with supply means according to this invention; and fig. 2 shows a similar burner provided with means for regulating the gas.

The upper end of the mixing-tube A is enlarged and turned over at right angles, forming a bend, the end of which is arranged in the form of a sleeve B for the reception of a gas-nipple C, and is provided with air inlet ports D. The sleeve is formed to receive a hollow plug F, preferably ground in gas-tight and recessed out in the middle so as to form the annular space G, to which gas is admitted from the pipe H and from which gas passes through apertures K to the gas-nipple.

When used in the form shown, the gas-nipple is carried at the end of a small piece of tube L screwed into the hollow plug F. In other forms, however, the passage by which the gas enters the injector plug may be in the same line as the mixing-tube A; the nipple being then in the gas-plug itself, and the gas entering from the top or other convenient position.

A pin and incline on the plug F and sleeve B ensure that the nipple is pointing in the right direction and exactly central to the tube A when the plug is forced home; and a suitable cap N encloses and holds in the plug.

The air regulation is effected (as in known types of burner) by rotating a sliding collar O surrounding the plug. The end of the collar projects to the outside of the lamp casing, and is readily accessible.

In some cases—particularly where varying pressures of gas have to be dealt with—it is desirable, the patentees say, to regulate the gas supply. This may be effected by fitting a screw pin R, as in fig. 2, centrally along the plug F, by which the effective area of the passage leading to the gas-nipple may be controlled or entirely shut off.

If desired, other gas regulating devices, such as conical valves fitting into suitable seats, and operated by eccentric pins, may be used; but

in all cases the gas-plugs carry the nipples in such a way that they can be readily removed without opening the lantern, or removing any other part of the lamp except the cap N.

When the burners are used for high-pressure lighting, the tube which carries the gas-injector nipple should be taken back to the end of the hollow plug and have fine holes drilled in it, so as to prevent the pressure from too suddenly entering the gas-injector when first turned on.

APPLICATIONS FOR LETTERS PATENT.

8689.—Johnston, A. G. K., "Regulating the supply of gases." April 11.

8787.—Leather, C. A. J., and Peach, E. M., "Gas-engines." April 12.

8820.—Feeny, V. I., "Gas-governors." April 12.

8842.—James, T., "Device for grilling and toasting." April 12.

8904.—Farrington, T. B., "Pipe-joints." April 13.

8917.—Richmond Gas Stove and Meter Company, Mead, A., and Taudevin, E. P., "Gas-heated brazing or like tables." April 13.

8978.—Legge, A. di, "Indicating escapes of gas." April 13.

9086.—Feld, W., "Extraction of tar and tar constituents from gases." April 14.

9091.—Lennox, A. B., "Gas-stoves." April 14.

9113.—Sutton, C. J., "Supports for burners." April 15.

9119.—Pease, E. L., "Obtaining power gases and sulphate of ammonia from refuse materials." April 15.

9144.—Raybould, A., "Gas-cocks." April 15.

9159.—Potter, W. G., "Gas-engines." April 15.

9169.—Brain, H. G, "Petrol gas." April 15.

9177.—Bueb, J., and Deutsche-Continental Gas-Ges., "Manufacture of ammonium carbonate." April 15.

9202.—Morand, G. A. A., "Lighting and extinguishing gas-burners." April 15.

9213.—Barlen, R., "Upright retorts for the distillation of tar, oils, and the like." April 15.

9249.—Byrne, J. F., and Lawrence, J., "Acetylene generators." April 16.

9293.—Koppers, H., "Doors of ovens for generating gas and coke." April 16.

9297.—Burstall, F. W., and the British Pure Fuel, Ltd., "Combination plant and process for purifying fuel and carbonaceous substances." April 16.

Improved Lighting of Blackfriars Road.

At the meeting of the Southwark Borough Council last Wednesday, the Works Committee reported that for some time past they had had under consideration the question of the lighting of Blackfriars Road, which in their opinion stands in great need of improvement. At present the road is lit by lamps fitted with a single inverted burner, the cost of which is £2 16s. per lamp. There are 54 lamps in the road, which makes the cost per annum £160 13s. The Borough Engineer (Mr. A. Harrison) suggested that the lighting of the whole of the road should be doubled by the fixing of twin inverted burners in each lamp. This would bring up the cost of each lamp to £5 5s. per annum, or a total annual expenditure of £283 10s. The cost of conversion would be 9s. per lamp, equal to £24 6s. Therefore the extra cost to the Council, exclusive of the cost of conversion, would amount to £122 17s. per annum. There is no doubt in the minds of the Committee that the lighting of the majority of the main roads in the borough is seriously in need of attention. The Committee have also had before them a list submitted by the Borough Engineer of the amounts paid by other Metropolitan Borough Councils for the lighting of their main roads, and they find that Southwark comes very low. The Committee are of opinion that Blackfriars Road should be taken in hand at once. They have also instructed the Borough Engineer to report to a future meeting with regard to the lighting of the other main roads in the borough. The Committee recommended: (*a*) That the 54 lamps in Blackfriars Road be fitted with twin inverted gas-burners, as suggested by the Borough Engineer; and (*b*) that the estimate submitted by the Finance Committee, amounting to £147 3s., being £24 6s. the cost of conversion and £122 17s., the extra cost of lighting per annum, be approved. This was agreed to.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Messrs. A. & W. Richards sold, by order of the Directors, 1000 new ordinary £10 shares in the Southend Water Company, ranking for a maximum dividend of 5 per cent.; the last dividend on similar shares having been at the rate of 4¾ per cent. They were all placed at par. At a recent sale at Torquay, some £10 shares (10 per cent.) in the Torquay Gas Company realized from £22 10s. to £22 15s. each, and some 7 per cent. shares of similar nominal value fetched £15 17s. 6d. to £16 apiece. Sixty £10 ordinary shares in the Exeter Gas Company were sold by auction last week at the price of from £16 7s. 6d. to £16 10s. each.

Suffocation by Gas.—Mr. Chester Ives, a London journalist, has just died under tragic circumstances at his residence, Thames Avenue, Molesey. Early on Friday morning a neighbour detected a strong smell of gas coming from the house. She fetched the police, who, failing to get an answer, forcibly entered the premises. Proceeding upstairs, they found the bed-room door locked, and the door had to be burst open. Mr. Ives was discovered lying on his bed and breathing heavily. In the room there was a very strong smell of gas; the gas-bracket being turned full on. After opening the doors and windows, the police endeavoured to restore respiration, and a doctor was summoned. Mr. Ives, however, died before medical assistance arrived. It was stated by the doctor that death was due to gas poisoning. The deceased gentleman had locked the door and taken the key to bed with him. A letter left by him is expected to throw light on the tragedy, as in it he explained that he had been troubled by failure in business. He had lately suffered from depression. He was a native of Buffalo, and was about 58 years of age.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Japan-British Exhibition.

Sir,—Your readers will, we think, be interested to hear some particulars of what is being done by the Committee that was appointed some weeks ago (at a meeting of representatives of Metropolitan and South of England Companies) to organize an exhibit at the Japan-British Exhibition.

Space amounting to nearly 1500 square feet has been secured in a good position in the "Decorative Arts Section," which will immediately adjoin the "Court of Honour."

A stand is in process of erection on this space, which will comprise on one side of the gangway a large oak-panelled salon, a kitchen, bedroom, and bathroom; and on the other side a show-room containing a selection of gas fittings, fires, and stoves.

The stands have been designed by an architect, and will, it is hoped, constitute a thoroughly attractive exhibit.

The cost will necessarily be considerable; and the Committee would be glad to have at their disposal at least £3000. Towards this sum, £2285 has been guaranteed by twenty-three gas undertakings in London and the South of England.

It is felt that there are very many other undertakings who would be willing to assist in making a thorough success of an exhibit which cannot fail greatly to stimulate interest in the domestic applications of gas among the many thousands who will visit the exhibition from all parts of the country.

The exhibition, as a whole, promises to be a great success—thanks largely to the strenuous efforts of the Japanese Government and people. The Committee, therefore, feel justified in appealing to their colleagues up and down the country to help make the gas exhibit worthy of the industry, by bringing the matter at the earliest possible moment to the notice of their Boards or Committees, and securing substantial additions to the list of guaranteed subscriptions.

For the Gas Companies' Joint Exhibit Committee,
D. Milne Watson, *Chairman.*
F. W. Goodenough, *Hon. Secretary and Treasurer.*

Offices of the Gaslight and Coke Company,
Horseferry Road, Westminster, S.W., April 22, 1910.

The Eaton Group of Companies.

Sir,—My attention has been drawn to your reference to the registration of the Gas and Water Works Finance and Contract Company, Limited.

It is true that some time ago I became a signatory to two of the companies known as of the Eaton group, and that was brought about through my firm being engaged in the registration.

I particularly wish to point out on this occasion, however, that the Company under notice is not in any way connected with the group referred to; and as a matter of fact I was careful on this occasion to inquire into that before becoming a signatory.

I should esteem it a favour if you will let your readers know that the Company in question has nothing whatever to do with the Eaton group, as from your remarks it might be taken otherwise.

89, *De Laune Street, S.E., April* 19, 1910. Harry A. Edgar.

Maintenance of Stopcock Box Covers on Private Services.—A correspondent would be glad of a reply to the following question: Are water companies liable to maintain the box covers of stopcocks on private services when they are fixed on the pavement or in the roadway?

New Joint-Stock Companies.—The gas engineering firm of W. C. Holmes and Co., of Huddersfield, has just been registered as a limited liability Company with a capital of £40,000, in £1 shares (30,000 preference). The Theale Gaslight and Coke Company, Limited, has been registered with a capital of £3000, in £1 shares, to acquire the undertaking, business, and goodwill of the Theale Gas and Coke Company, Limited (in liquidation), and to enter into an agreement with W. Phillips; also to manufacture, sell, and supply light in Theale and the surrounding districts in Berkshire, and to carry on the business of a gas company in all its branches.

Manchester Corporation Water Undertaking.—The accounts for the past year show a net surplus on revenue account of £1440, though in April last year there was an adverse balance of £21,244 to start with. The consumption of water during the year exceeded, on an average, 41 million gallons per day. At the Thirlmere works the supply averaged more than 18 million gallons per day. The Committee estimate that the income from the department for the present year will be £412,500, which will give them a surplus of £1972. The estimated expenditure on capital account is £485,000, compared with £241,921 for the past year. It is contemplated to spend during the twelve months £290,000 on the third line of pipes from Thirlmere, and £115,000 on the Heaton Park reservoir.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Little Hulton Urban District Council Bill, Mallow Urban District Gas Bill, Pontypridd Water Bill.

Bill read a second time and committed: East Grinstead Gas and Water Bill.

Bills read the third time and passed: Cambridge University and Town Water Bill, Garnant Gas Bill, Gas Companies Standard Burner (No. 1) Bill, Gas Companies Standard Burner (No. 2) Bill, Gas Companies Standard Burner (No. 3) Bill, Matlock Bath and Scarthin Nick Urban District Council Bill, South Lincolnshire Water Bill, Thorne and District Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills brought from the Lords, read the first time, and referred to the Examiners: Cambridge University and Town Water Bill, Garnant Gas Bill, Gas Companies Standard Burner (No. 1) Bill, Gas Companies Standard Burner (No. 2) Bill, Gas Companies Standard Burner (No. 3) Bill, Matlock Bath and Scarthin Nick Urban District Council Bill, South Lincolnshire Water Bill, Thorne and District Water Bill.

Bills read a second time and committed: Gowerton Gas Bill [Lords], Staffordshire Potteries Water Bill.

Bills reported: Egremont Urban District Council (Gas) Bill, Exmouth Gas Bill, Exmouth Urban District Water Bill, Farnham Gas and Electricity Bill [Lords], Mountain Ash Water Bill, Slough Water Bill, South Hants Water Bill, Wishaw Burgh Extension Bill [preamble not proved].

Bills read the third time and passed: Little Hulton Urban District Council Bill, Mallow Urban District Gas Bill, Wicklow Gas Bill [Lords].

The Water Provisional Order Bill, to confirm the Sutton District Water Order, has been presented, read the first time, and referred to the Examiners.

The Nottinghamshire County Council have withdrawn their petition against the Shirebrook and District Gas Bill.

BRADFORD CORPORATION BILL.

THE GAS AGREEMENT.

Local Legislation Committee.—Thursday, April 21.

(*Before Mr.* C. N. NICHOLSON, *Chairman, Mr.* HARRISON-BROADLEY, *Mr.* HELME, *Mr.* W. E. HORNE, *Viscount* LEWISHAM, and *Mr.* MIDDLEBROOK.)

Part 8 of the Bill promoted by the Bradford Corporation related to gas, and dealt with the confirmation of an agreement dated Dec. 19, 1907, between Henry Ripley, Hugh Ripley, and Edward Guy Ripley as Trustees under the will of the late Sir H. W. Ripley and the Corporation. On this clause, the Local Government Board made the following observations: "The Committee will no doubt require to be satisfied that the price agreed to be paid for the undertaking represents its reasonable value to the Corporation in its present condition. It is presumed that the Corporation propose to use the gas-works to which the clause relates for the supply of gas; and it is suggested that the Bill should provide that the gas-works should be held as part of the gas undertaking of the Corporation, and subject to the provisions of the local Acts governing that undertaking."

Mr. BOYCE (representing the Local Government Board) said the second part of their criticism was met; the only point was as regarded the value of the property.

Mr. JEEVES (for the promoters) said the only thing the Local Government Board desired the Committee to do was to satisfy them as to the value of the undertaking. This they would have been prepared to do, whether they had so desired or not.

Mr. BOYCE said that although the agreement might have been a perfectly proper amount in 1907, it did not necessarily follow that it was so at this time.

Mr. JEEVES admitted this was so; but what it meant was that instead of the £15,000 it perhaps ought to be £20,000. The position was this, that the Corporation since 1871 had been the owners of the gas undertaking for the whole city with slight exceptions. There were now three small areas of supply that overlapped the existing city boundaries—the Drighlington and Gildersome Gaslight Company, the Pudsey Gas Company, and the private gas-works owned by the Trustees under the will of Sir H. W. Ripley. The policy of the Corporation, of course, always had been to be suppliers of gas for the whole area. This had afforded the opportunity of closing up one area supplied by other people. It was quite true that the greater part, if not the whole, of the gas manufactured at these works was supplied to people on the estate. But it was gas supplied within the City affording a very considerable supply and a source of income if the Corporation absorbed it into their own undertaking. An opportunity arose a year or two ago for the purchase of this undertaking. They availed themselves of it; and they had a Bill last year which was thrown out by the ratepayers. So it happened that it had had to wait two years for confirmation. This property consisted of the works and eight cottages; and the land itself was an area of 4838 square yards. The area supplied from the works was 30 acres. Another point was that it was very undesirable to have these little gas-works.

Mr. *Charles Wood*, the Gas Engineer to the Bradford Corporation, said the area that the works had been supplying was about 30 acres, and there were 49 Corporation public lamps supplied from it. The 30 acres were entirely within the area of supply of the Corporation. By reason of Sir William Ripley owning the whole, he was enabled to continue the supply himself.

Mr. JEEVES: In your view, is the price of £15,000 a proper one for the Corporation to pay for the works?

Witness: It is very reasonable. I may say that it is the lowest price for the amount of gas sold of which I am aware.

Will the revenue you get from the area of this undertaking enable you to pay the expenses in connection with the purchase?—Yes.

In addition to this, will you be able to supply the residents in that particular 30 acres with gas at a more reasonable price than they are at present obtaining it at?—They are getting it now at the same rate as charged by the Corporation. We shall be able to make gas more cheaply on our large works than is possible in such a small works as Messrs. Ripley's.

Witness, continuing, said this meant that the price of gas would be the same; but the margin of profit obviously would be greater. They were to pay £15,000 for the goodwill and for the land, which would be valuable when the works were dismantled. The actual area was about an acre; and being within less than half-a-mile of the centre of the City, it should be valuable land. Some of the plant had been there for nearly 50 years. This portion, of course, was worn out; and they would wish just to continue the works for a short time to wear out the plant. They had large gas-mains practically surrounding the works; so that there would be very little extra cost to them to supply Messrs. Ripley's district from their own larger works.

Replying to Mr. HELME, witness said the quantity of gas supplied from these works was about 32 million cubic feet per annum.

Answering the CHAIRMAN, witness said the approximate value of this particular acre of land would depend upon who wanted it; but he should think it would fetch £3000 or £4000.

The CHAIRMAN: You would be paying £11,000 for the goodwill practically and for a rather worn-out plant?

Witness: Yes; but the mains and meters will be worth £3000 or £4000.

Mr. JEEVES: It is suggested to me that, roughly, this land would be worth about £1 a yard, judging by other property—that would be practically £5000?

Replying to the CHAIRMAN, who said he was only trying to arrive at a conclusion as to whether £15,000 was a reasonable sum for the Corporation to pay, witness said that, calculated on the price paid per million cubic feet of gas sold, this particular purchase would be the lowest which had taken place for, at any rate, the past 20 years. It was very much lower than they had paid for statutory gas undertakings surrounding Bradford. It was less than half the price that was provisionally agreed some years ago between the Corporation and Messrs. Ripley.

The CHAIRMAN intimated that the promoters might take the first subsection of the clause; and it was passed. Respecting sub-section 2, he said he noticed that there was a proviso "that the Corporation shall not, unless authorized by Parliament so to do, manufacture gas upon any lands vested in them under or in pursuance of the said agreement." Mr. Wood had told them that they proposed to manufacture for a certain period.

Mr. JEEVES pointed out that they could not, under the Standing Orders, take any statutory authority for this purpose. They were bound to put this proviso in.

Mr. *Wood* having been recalled, sub-section 2 was passed; and part 8 was added to the Bill.

UNOPPOSED PRIVATE BILLS.

(*Before Mr.* ALFRED EMMOTT, *Chairman, Mr.* WHITLEY, *Deputy-Chairman, Mr.* J. W. HILLS, *Mr.* MOON, and *Mr.* VIVIAN.)

The Unopposed Bills Committee, constituted as above, had before them on Thursday last the following Bills.

Bishop's Stortford, Harlow, and Epping Gas and Electricity Bill.

Mr. BERRY, on behalf of the Parliamentary Agent, stated that the Bill was promoted by the three statutory Companies of Bishop's Stortfore, Harlow, and Epping, and by the Ongar Gas Company—the latter being a limited Company, with no statutory powers. The proposal was to enable the three statutory Companies to amalgamate, take over the Ongar Company, and absorb two other limited Companies which were within the area. The two Companies were very small—having capitals of £2400 and £1400; and they were technically competing Companies. Under the amalgamation, the area of supply would extend through the boundaries of ten local authorities, all of whom had conferred with the promoters and were satisfied with the proposals in the Bill. Certain objections certainly had been raised by them; but these had been met by amendments. The object was to effect economies by enabling the amalgamated Companies to buy material on a larger scale and concentrate their works; and by the linking-up of the various districts they would get rid of the difficulty with regard to the non-statutory Companies. With regard to capital, the basis of the Bill was all 5 per cent. In the case of Bishop's Stortford, where there was both 7 per cent. and 5 per cent. stock, the holders of the 7 per cent. stock got £140 of new stock for every £100 of old stock, and the holders of the 5 per cent. stock would have in exchange the equivalent in 5 per cent. new stock. The standard price was 4s. per 1000 cubic feet; the actual price charged being 3s. 9d. The dividend earned was 7¾ per cent.; and they paid 7 per cent. In Epping, the price was 4s. 3d.; but they were selling at 3s. 9d.; in Harlow, it was 3s. 11d., and they were selling at 3s. 8d. So that under the proposal in the Bill to make a charge of 4s., in Epping there would be a loss of 3d., and in Harlow a gain of 1d. In Stortford, it remained the same. The Harlow Company were paying a dividend of 5 per cent., and the Epping Company of 5¾ per cent. There was an inner and an outer area; and the Bill provided that the price in the outer area should not be 1s. in excess of that in the

inner area. In the inner area, there was a close population; in the outer area, it was open country. But the price in the outer area might be reduced so that they should get gas as nearly as possible at the same rate as that in the inner area. The population in Bishop's Stortford was 12,000; in Harlow, 6000; in Epping, 6000; and in Ongar, 2200. At present, the Ongar Company were charging 3s. 6d., and paying a dividend of 10 per cent. There were two stocks in the Bill; and they had reduced the 5s. sliding-scale to 3s. 6d., so that the "A" stock got a 3s. 6d. sliding-scale, and the "B" stock a 2s. 6d. sliding-scale. Of the additional share and loan capital, some was required for gas and some for electricity; the total capital to be authorized under the Bill being £240,000. They were also asking for power to supply electricity in the urban district of Bishop's Stortford and a few outlying villages. In 1905, the Council obtained a Provisional Order to enable them to supply electricity. But on going more thoroughly into the matter, they were doubtful as to whether it would be a financial success; and eventually they sold their Order to a private Company for £250. The Company were, however, unable to make any progress in the matter. The Gas Company, having already the land and so on, would be able to reduce the working expenses when run in connection with the gas undertaking, and using suction gas they would be able to work at a price at which no private company could sell. At first, the Council were opposed to the idea; but in consequence of a clause which was inserted in the Bill, they were now satisfied. With regard to the reserve fund, the only effect was to enable them to equalize dividends; and this tended to keep up the value of the stock when they came to issue additional capital, and of which the consumer got the advantage.

Mr. *E. L. Burton*, the Chairman of the Bishop's Stortford Gas Company, said they (the three Companies) were entitled to further capital under their existing Acts to the extent of £83,250, including loan capital. In addition to this, upon the further development of the district they were asking for powers to raise £46,000 share capital and £28,000 loan capital. They further asked for £30,000 share capital and £10,000 loan capital for the purposes of the electricity undertaking. The additional capital should last—assuming that the rate of increase was the same as in the past three years—something like 12 or 15 years. The consumption of gas in 1909 was 96 million cubic feet; and in 1903 it was 61,867,000 feet. Accordingly, the sale of gas 15 years hence would be 317 millions. Taking the increase of sale at £800 per million, and putting that to the existing capital, and including £40,000 for the electrical undertaking, they would require £340,000 altogether. They were asking for £320,000.

Mr. HILLS: Do you think you could make the electricity undertaking pay in spite of the fact that the Local Authority and private Company have fought shy of it?

Witness: Yes. We have the lands, buildings, and so forth, which can be adopted.

Replying to further questions, witness said they were not looking forward to an immense increase in sales of gas in the near future. There were companies in the suburbs of London which had much higher prices; in fact, he knew of no other company in the county of Herts, with one exception, who had a lower standard price than 4s.

Mr. *Snell* gave evidence to the effect that gas was to be used for driving electrical plant. He thought the electrical undertaking should be self-supporting in its third year.

Mr. *E. H. Stevenson*, in reply to the CHAIRMAN, said it would be unwise to alter the standard price. He thought 4s. was fair all round. If the Committee were to alter the standard price, it would depreciate the gas stocks and would damage the consumer much more than the shareholder, because at present the consumer got the capital for new works at the very cheapest rate in the market. It had never been done, with one exception; and that was where a company had a high standard price of 5s., and they never thought of paying more than the standard dividend and put everything to the reduction of the price of gas. The company admitted that they had never used the sliding-scale, and never intended to do so; and the Committee reduced the standard price to 4s. 6d.

The CHAIRMAN: Supposing that these Companies with which we are now dealing were old companies with a 5s. standard rate, would not your arguments apply equally to that?

Witness: If they had never used it, I should say it would not do any harm to reduce it.

Continuing, witness said where a Company came to Parliament and asked for something which would increase the benefit which Parliament had given them, then Parliament had said: "If we give this, it must go to the consumer." With regard to electricity, the position taken up by the promoters was that some day or other—it might be in 10 years or 20 years—electricity would be in great demand; and if they had the power, they would be able to supply it at a fairly reasonable price. His own opinion was that it was better for the gas consumer that the Company should have the electrical powers than that they should be in the hands of an outside company.

Mr. *Cooper*, a member of the Bishop's Stortford Council, said the previous Council opposed the idea of the electricity undertaking being carried on by the Council; and of the new Council—which was quite recently appointed, and had not yet met—he knew that 9 out of 15 members were in favour of the Gas Company having charge of the matter.

Mr. BERRY pointed out that the promoters could not use their electrical powers if the Council chose to go on with their Order; and the Company would not go on till the Order was revoked by the Board of Trade.

Eventually the Committee decided to pass the preamble of the Bill with regard to gas; but they were not satisfied on the question of electricity. The decision on this part of the Bill was therefore postponed until the new Council of Bishop's Stortford have met, with the object of seeing if the Council desire to put in a plea by a late petition.

Farnham Gas Bill.

The Agent with regard to this Bill explained that its object was to incorporate a limited Company and give power to supply electricity. Under a Provisional Order of 1899, gas of 15-candle power was supplied at a maximum price of 3s. 9d. Now they were asking to extend the limits of supply, to use roads for electricity purposes, substitute a standard price of 3s. 6d. for the maximum price of 3s. 9d., and reduce the illuminating power to 14 candles. The present capital authorized was £49,200, of which £29,200 had been raised—there being a balance of £20,000 unissued. The borrowing powers were £12,300, of which £6800 had been raised. The total authorized share and loan capital amounted to £61,500, of which £36,000 had been issued. They were asking in the Bill for a capital of £60,000 and £20,000 borrowing powers. The estimated cost of the electricity undertaking was £18,500. A clause had been inserted in the Bill, at the instance of the Local Authority, which provided that if they failed to exercise their electrical powers, the Board of Trade might revoke the Order; and in that event, their capital powers were to be reduced by £18,500. In 1902, the price charged for gas was 3s. 9d.; and the Company were paying 5 per cent. From 1903 to 1905, the price charged was 3s. 6d., and the percentage the same; and for the past three years the charge had been 3s. 4d., and they paid a dividend of 7 per cent. as authorized in their Provisional Order.

Replying to Mr. MOON, the Agent said there were gas companies who had already been authorized to supply electricity. The Ascot Company were at the present time supplying.

Mr. *A. H. Dykes*, the Consulting Engineer to the Ascot Gas and Electricity Company, said that practically a supply of electricity was not given until the middle of 1907. In the first completed year's working, the revenue was £1330, and from the gas undertaking in that year £9240. The following year, it was found that the supply of electricity did not stop the sale of gas. The total cost of the production of gas in 1909 was £7130, as against £7293 in the previous year. Although the consumption of gas had increased, the cost of production had decreased. In 1907, the management charges in regard to gas amounted to £903, and last year to £735. They found that the gas expenses were helped when shared with the electricity undertaking. In their Act, the charge was 8d. per unit; but they were supplying at 5d. and 6d.

Mr. MOON: What dividend does it pay?

Witness: On the electricity undertaking alone, there is a return of 3·16 per cent.

The CHAIRMAN: Then you actually made a profit on the gas production in running the electricity?—That is so.

How soon do you calculate that the scheme proposed by the Bill will be self-supporting?—That, of course, is a matter which is in the hands of the Directors of the Company.

In what way, for better or worse, does the Farnham district differ, from the point of view of the electricity undertaking, from that of Ascot?—I think the circumstances are very similar, with the exception that Farnham is more closely built, and the demand is likely to be more nearly round the works.

Mr. *Edgar Kempson*, a member of the Farnham Town Council, said the Council had passed a resolution assenting to the electricity proposals in the Bill.

Mr. BERRY having pointed out that everything in the reports of the Local Government Board and Board of Trade had been complied with, the Bill was ordered to be reported to the House.

Egremont Urban District Council Bill.

MR. CROWTHER, the Agent for the Bill, remarked that the proposal was to acquire, by agreement, the undertaking of the Egremont Gas-light and Coke Company. This was a non-statutory Company; and the price to be paid for the undertaking was £6500. The reason why the Council desired to obtain possession was that the Company could not properly or adequately supply the present number of consumers. The Cleator Moor Urban District Council supplied a small portion of Egremont with gas; and there was also an agreement with regard to them that the Council should take over the pipes in their district at a price of £579 10s. 7d. It was also proposed by the Council to acquire additional lands and construct new works, because the present works were not capable of supplying the necessary gas, and there was an increasing population. The district to be supplied was that of the Egremont Urban District Council and a small area adjoining. The price to be charged was 5s. 6d. per 1000 cubic feet; and the quality of the gas was 14-candle power.

Mr. *W. Newbigging* said the Company had, especially in the matter of pressure, failed to supply the demand for gas. Although the works had been well maintained, they were now old; and it was proposed to build a new retort-house. The production of gas per ton of coal was at present unsatisfactory.

Mr. MOON: Why is it possible for the Council to extend the mains while the Company cannot?

Witness: I think it rather shows want of foresight on their part.

Mr. CROWTHER: I understand they are not willing to do it.

Continuing, witness agreed that 5s. 6d. was an unusually high price; but the price of coal was high. The Council's object was to get the price down.

Mr. VIVIAN: What will be the effect of the purchase price on the shareholder?

Witness: He will get his money back again and no more. I do not wish to say anything harsh about the Company; but they certainly have not made as much out of the undertaking as they might have done.

Mr. MOON: If we gave a maximum of 5s., you would not come on the rates, would you?

Witness: I think it would be running it rather fine.

Mr. CROWTHER pointed out that the periods for repayment were low. With regard to land, the period was 40 years, instead of the usual 60 years, and for the repayment of purchase money and the extension of works 30 years—the usual period being 40 years.

The Bill was ordered to be reported.

Exmouth Gas Bill.

This is a Bill to obtain additional capital powers and to extend the limits of supply.

Mr. *J. T. Foster*, the Engineer of the Company, gave evidence, and said they were not asking to alter the standard price of 5s. which was

given under their Act of 1882. The average price charged in the last ten years was 3s. 8d., and the price actually charged now was 3s. 5d.

Mr. HOOKER, the Agent for the Bill, said there was objection to any alteration of the standard price, because it was upon the standard price that the capital had been subscribed. They had never paid more than the standard dividend, although they might have done so.

Mr. HILLS said that stock had surely changed hands since 1882 with the expectation that higher dividends would be paid.

Mr. MOON drew attention to clause 41 of the Bill, which provides as follows.

Notwithstanding anything contained in the Gas-Works Clauses Act, 1871, or any other Act, a person shall not be entitled to demand from the Company a supply or the continuance of a supply of gas for premises having a separate supply—that is to say, a supply from an installation other than that of the Company—unless he shall have previously agreed to pay the Company such minimum annual sum as will give to them a reasonable return on the capital expenditure and standing charges incurred by them to meet the possible maximum demand for the premises, and the minimum annual sum to be so paid shall be determined, in default of agreement, by arbitration in manner provided by the Arbitration Act, 1889.

Mr. HOOKER: There was an exact precedent for this in the case of Mountain Ash. It was a clause which gas companies had been asking for, and last session it was given in two cases in favour of two local authorities. In reply to the CHAIRMAN, he said there was no case in their area of people having their own supply of gas; but there might be in the next 10 or 12 years.

The Bill was ordered to be reported.

THE PROTECTION OF WATER SUPPLIES.

The Joint Committee of the House of Lords and the House of Commons appointed to consider the Water Supplies Protection Bill commenced their sittings last Wednesday. Lord MACDONNELL presided.

Mr. *J. Lithiby*, the Legal Adviser to the Local Government Board, in the course of a long statement, explained the law with regard to water supplies. The law as to the use of underground water, he said, had not been altered for a great number of years. Practically it was the same as the law of Ancient Rome, as laid down by Justinian, according to which if a man dug a well in his own field and thereby drained his neighbours, he might do so unless he acted maliciously. The only part of the Roman law on this point which was not British law to-day was that which related to the doing of the action maliciously; for it had been held that no use of property which would be legal if done for a proper motive could be illegal if done for a motive which was improper or malicious. By the English law, power to take underground water was absolute. The same law applied to defined streams whether above or below the surface. On the authority of a number of cited cases, it appeared that water could not lawfully be extracted from any stream for sale or for the supply of the inhabitants of a neighbouring area by any riparian owner without the aid of a Statute. So far as he knew, no report had ever been prepared which dealt with the water supply of England as a whole—that was to say, with the water supply of the country from underground sources as a whole. But in many parts of England wells had been sunk, and geologists had been keen to inquire as to the strata disclosed by the sinking of the wells. Therefore, information was available in a general way as to the conditions in various places. Also in the course of the geological survey a great deal of information had been collected in regard to the water-bearing strata. The jurisdiction of the Local Government Board in connection with Water Provisional Orders went a long way—indeed, it went far enough to protect those who were likely to be injured by the abstraction of water. Local inquiries were held before Provisional Orders were granted. The Local Government Board and its system of Provisional Orders afforded adequate protection to tracts which were not covered by being mentioned in an Act of Parliament. The provisions in the Bill before the Committee would require very careful consideration. Restrictive provisions in Local Acts had been inserted by agreement or after full inquiry before a Parliamentary Committee. This was also the case with regard to restrictions contained in Provisional Orders; but the present Bill proposed to alter the general law as well as the law contained in Local Acts. In many cases it might prevent the abstraction of water from areas where it was useful; but it would certainly prevent local authorities and companies from carrying out statutory duties which devolved on them. If clause 3 of the Bill became law, no corporation, urban district council, or rural district council would be able to sink a well or construct other works for taking or intercepting water without applying to Parliament. This would give rise to considerable difficulty. In cases in which the power could be obtained by a Provisional Order issued by the Local Government Board or Board of Trade, the expense would not perhaps be very material; but in cases in which a Local Act had to be obtained, the cost would be considerable. In no instance in which a supply of water was given under the provisions of the Public Health Act could the supply be extended in the manner referred to without incurring this considerable expense. At present a rural district council could not apply to Parliament. Clause 3 was much too restrictive and altogether unnecessary in cases in which local inquiries had been held. It should not therefore be inserted in Provisional Orders; nor was it necessary in cases in which Parliament had had an opportunity of seeing all the details of a Bill. It was the practice of the Local Government Board to apply in Provisional Orders the powers and the restrictive provisions of the Public Health Act, and thus to extend sufficient protection to all parties. If the Local Government Board were able to grant a local authority power to acquire water rights compulsorily, the powers of the Board would be ample. The question before the Committee was exceedingly difficult. Undoubtedly there had been a great amount of litigation over water and water undertakings; and it was desirable that further legislation should be undertaken with a view to improving the situation. While, however, the present Bill was a movement in the right direction, it did not cover the ground as it ought to do; and no Bill could cover the ground properly until they had such information as one of the Royal Commissions had suggested respecting the water-bearing strata of the country. Litigation would increase, rather than diminish, as a result of the Bill. It was not necessary that Parliament should deal, by means of Private Bills, with questions such as those to which the Bill related. A Government Department could deal with them satisfactorily under powers conferred on it by Act of Parliament. Local authorities were, he thought, sufficiently protected now by the Local Government Board. The difficulty with regard to rural district councils could possibly be met by excluding them from the purview of the Bill. He was not aware that local authorities were so dissatisfied with the present position that they desired the Bill. The powers of the Local Government Board were satisfactory, except as regarded the larger water undertakings; and in respect of these, applications were made to Parliament. Clause 4 of the Bill, which provided for giving compensation for injury caused by the abstraction of water, would probably cause a great deal of litigation. The onus of proof was placed on the local authority. Therefore, if a man's pond, situated within 2½ miles of a pumping-station, for some reason or other dried up, it would devolve on the water authority to show that the drying-up was not caused by anthing done at their water-works. It might, and in some cases it would, be extremely difficult for the water company to prove the negative; and if they failed to do so, they would be required by the clause to pay compensation. The compensation, failing agreement, was to be settled by arbitration. Thus the expense which local authorities might incur would be so considerable as effectually to prevent them developing or extending their works for the supply of water. In a dry season, the effect of the clause might be disastrous. Under clause 5, the undertakers were to be liable not only to give a bulk supply to the county district from which they drew their water, but also to every county district through which their line of pipes might pass. In some cases they would possibly have to give more water to areas through which their pipes passed than they wanted for their own district; and in any case the obligation to supply to every county district in which the pipes were laid would impose a very heavy burden on them. A proposal had long been under consideration for conveying water to London from Wales. While there was something to be said in favour of the Metropolitan water authority giving water to the Welsh districts from which the supply was to be drawn, and while something might be said in favour of giving a supply of water to the county districts bordering on these areas, it was difficult to see why the Metropolitan authority should supply water to county districts which would never think of going to Wales for their supply, merely because the Metropolitan authority's pipes happened to pass through those county districts. Assuming, for instance, that the Wales to London pipes passed through Oxfordshire, Gloucestershire, and Buckinghamshire into Middlesex, it was difficult to see why the Metropolitan authority should supply the county districts of these counties with water which the London ratepayers had paid to bring from Wales. There was a clause in the Metropolis Water Act of 1902 which authorized the supplying of water by the Metropolitan Water Board in certain areas in Herts through which the pipes of the Board passed. This was to some extent a precedent for clause 5 of the present Bill. There were numerous other cases in which, by agreement, water companies supplied not only in the area from which they drew their supply, but to various authorities on the route of their pipes. It being suggested that a claim to a supply under clause 5 could only be sustained if the Local Government Board approved of it, witness pointed out that if it were laid down as a general principle that a certain thing should be done, and that then power were given to the Local Government Board to adjudicate in exceptional cases, no doubt the general position would be to a certain extent relieved. But the Local Government Board, in approaching (say) an application from Oxfordshire, would have to consider that, unless some special reason were shown, the general principle of the Act would govern.

LEGAL INTELLIGENCE.

CONNECTION OF GAS-MAINS TO PUBLIC LAMPS.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Wednesday, April 20.

(*Before Mr. Justice* PHILLIMORE.)

Liverpool United Gaslight Company v. Corporation of Liverpool.

This was a case stated by Mr. Frederick Arthur Greer, the Umpire in an arbitration between the parties, for the opinion of the Court, under the following circumstances. The Company claimed to be entitled to £5063 13s. for work done and material supplied, at the request of the Liverpool Corporation, in making, between their mains and lamps erected by the Corporation in certain passages in the city, the connections required for the purpose of supplying gas to the lamps. The Umpire found that (1) it was not proved that at the time when the orders were given, and the work was done, the unadopted passages had not become public highways; and (2) that at all such times the public had in fact free access to the passages, though it was not proved that they had acquired any legal right to use such of them as were unadopted without the consent of the owner of the soil. He also held that the Company were under statutory duty to do the work at their own expense in all cases where the lamps were public lamps; that the lamps in the adopted passages were public lamps; and that the Corporation, by requesting the Company to do the work in the adopted and unadopted passages, impliedly promised to pay the Company the fair and reasonable price if it should turn out that the Company were not under statutory duty to do the same at their own expense. He awarded £5063 13s. as the amount of the work done and for labour; and the question for the Court was whether he was right.

Mr. MACMORRAN, K.C., and Mr. RYDE appeared for the Company; and the Corporation were represented by Mr. DANCKWERTS, K.C., Mr. F. E. SMITH, K.C., and Mr. COURTHOPE MUNROE.

Mr. MACMORRAN said the question raised by this case was whether

a gas company who were under statutory obligation to supply gas to public lamps must do so at their own cost in the way of supplying the pipes necessary for the conveyance of the gas to the lamps; and there might also be another question as to whether certain of the lamps dealt with were public lamps. Having read the special case, and called attention to the provisions of various Acts of Parliament, Counsel submitted that it was the duty of the Corporation to provide the lamps and of the Company to supply the gas.

Mr. DANCKWERTS argued that the lamps in question were "public," as they had been put up by the Local Authority at the expense of the ratepayers for the convenience and use of the public or for sanitary and police reasons.

Thursday, April 21.

Mr. DANCKWERTS, resuming his argument this morning, contended that the word "street" in the Act included not only highways but all private streets, and as such were bound to be lighted. He referred to the case of the *Alliance and Dublin Consumers' Gas Company v. Corporation of Dublin* decided by the Irish Courts in May, 1895 (which he said was reported in the "JOURNAL OF GAS LIGHTING" only*), as showing that it was the duty of the Gas Company to lay the pipes within a certain distance without making any charge, as under section 24 of the Gas-Works Clauses Act, 1847, they were bound to supply gas to the public lamps. With regard to the question of whether the price charged for the gas was to include the cost of laying the mains, he said he did not propose to trouble the Court with any argument, as the Corporation had left themselves entirely in his hands in this matter.

At this stage a consultation took place between Counsel. As the result,

Mr. MACMORRAN said he did not know whether or not his Lordship could help them, but he had suggested terms to his learned friend which would deal with the dispute in the future, though there was some difficulty with regard to past charges.

Justice PHILLIMORE said he was rather inclined to favour the contention raised by the Corporation as to lamps in adopted and unadopted streets; but his difficulty was as to what the parties meant by the agreement into which they had entered. He could not find that they ever made an agreement except with respect to court and street lamps, as to which the Corporation had to pay for the former and the Company for the latter. When the Company were asked to light the passages, they said they were not bound to do this. After some negotiation, the work was done; and surely the Company were entitled to a reasonable sum for it.

Mr. DANCKWERTS said there was no difference between street lamps and passage lamps.

Justice PHILLIMORE did not say there was in law, but the parties had evidently made a bargain. When the Corporation were settling the price they should pay, it was conceivable that they might say, as to certain parts of the town, that they would pay 10 per cent. less than the private consumers paid, and as to another part 5 per cent. less. And so, in the same way, it was conceivable that when they were bargaining the Corporation might have said to the Gas Company: "You shall put the pipes into the streets, and be paid the price for putting gas into the courts and half the expense for putting the pipes in the passages." If the parties only agreed about the courts and streets, they never agreed about the passages. This seemed to be the difficulty. Very early in the negotiations, the Company said they had agreed about the courts and streets, but did not recognize the passages.

Mr. DANCKWERTS remarked that this was because they were not public lamps. His view was that the question of whether there was a difference between street and passage lamps had not been considered, and they had not all the materials before them to decide it. The most satisfactory way of dealing with the difficulty would be either to arrange it between themselves or to send it back to the Umpire. The question was not as between street or non-street lamps, but as between public and non-public lamps. The only question which had been discussed was as to whether the lamps in question were public lamps; and, if so, whether the charge by virtue of section 24 covered the cost of laying the pipes.

Justice PHILLIMORE said he thought that must be so.

After a further conference between Counsel, Mr. MACMORRAN said the parties had negotiated, and terms had been suggested; but there was a little difficulty on both sides about the question of authority to make a settlement. Under these circumstances, he suggested that there should be a short adjournment.

His LORDSHIP ordered the case to stand over till Tuesday, May 3.

* See "JOURNAL," Vols. LXV. and LXVI.

Action in Respect of Gunning's Controllers.

In the King's Bench Division of the High Court of Justice, at the close of last week, Mr. Justice Walton had before him an action brought by the British, Foreign, and Automatic Light-Controlling Company, against Messrs. J., M., & D. Fellheimer, for damages for alleged breach of contract. Mr. Marshall Hall, K.C., who appeared for the plaintiffs, said that in 1905 the defendants entered into a contract to supply 10,000 clock movements to the Company, whose business was bought by the plaintiffs, together with this contract and the sole patent rights in Gunning's patent controllers. They claimed damages in respect of the non-delivery of 8000 movements according to sample within the contract time; and they also asked for an injunction to restrain the defendants from using Gunning's patent. The defendants, for whom Mr. Clavell-Salter, K.C., appeared, denied that they entered into the contract, which, they said, was made with the Union Clock Company, whose works are in Germany, and for whom they were merely agents. They admitted that there had been a breach of contract, but denied responsibility; and, furthermore, they said that the damages claimed were excessive. They also denied the allegations made against them in respect of Gunning's patent. Evidence on both sides having been given, it was announced that a settlement had been come to—judgment to be given for the plaintiffs for £50, with costs on the High Court scale. His Lordship entered judgment accordingly.

WATER COMPANY'S RIGHT TO SINK A WELL.

Successful Appeal by the Barnet Company.

Early in July last year, Mr. Justice Ridley had before him, in the King's Bench Division of the High Court of Justice, an application made by the Attorney-General for an injunction to restrain the Barnet District Gas and Water Company from constructing or using, upon a piece of land acquired by them at Colney Heath, "a well or other works for the purpose of raising, collecting, or storing water, and from carrying the same away for the purpose of their general undertaking." The action was brought at the relation of the Marquis of Salisbury, who is the tenant for life in possession of Hatfield House, which includes nearly the whole of the town of Hatfield and the village of Essendon, and who has had for many years upon his estate wells which supply the town with water. By an Act obtained in 1904, the Company were empowered to construct a reservoir and make certain subsidiary works; and by section 15 it was provided that if the reservoir was not completed within three years from the passing of the Act, the powers granted by it should cease. But nothing therein contained was to restrict the Company from at any time renewing, extending, enlarging, altering, reconstructing, or removing certain of their existing works, increasing or improving the supply of water, or exercising any of the powers with respect to the construction of works from time to time as occasion might require. They had acquired a piece of land at Colney Heath, and had commenced to sink a well for the purpose of obtaining a new water supply. It was alleged that this well was outside their statutory powers, and that its construction would cause damage to the relator. The case for the Attorney-General was argued by Sir Alfred Cripps, K.C., Mr. Danckwerts, K.C., and Mr. Eustace Hill; Sir Robert Finlay, K.C., Mr. Balfour Browne, K.C., and Mr. J. D. Crawford representing the defendants. His Lordship's attention was directed to the now well-known Frimley and East Grinstead cases; and it was submitted for the plaintiff that the one under consideration could not be distinguished from them. On behalf of the defendants, however, it was contended that it was of a totally different character. In the result, his Lordship acquiesced in the former view, granted the injunction, and ordered the defendants to pay the costs. These proceedings were reported in the "JOURNAL" for July 13, 1909 (p. 125).

The Company appealed; and the arguments were heard by Lords Justices Vaughan Williams, Buckley, and Kennedy on the resumption of the sittings in October last. They reserved judgment; and it was delivered a few weeks later. Unfortunately, their Lordships were not unanimous; Lord Justice Vaughan Williams considering that the judgment of the Court below should be affirmed, while his learned brethren were of the contrary opinion. Lord Justice Buckley said he thought that in sinking the well in question the Company were not acting *ultra vires;* and that therefore the injunction which had been granted was wrong. The order made must be discharged, and judgment entered for the defendants, with costs. Lord Justice Kennedy, who had perused and considered the written judgment of Lord Justice Buckley, said it so completely and exactly expressed the reasoning which appeared to him to be correct, that he desired simply to express his concurrence with it. It was intimated that the Attorney-General purposed taking the opinion of the House of Lords on the question at issue; but it was decided that meanwhile the sinking of the well should not be stayed. The judgments above referred to were given in the "JOURNAL" for Nov. 16 (p. 480).

The further appeal came before the Lord Chancellor, the Earl of Halsbury, Lord Shaw, Lord Atkinson, and Lord Mersey on Monday last week; and, after hearing Sir Alfred Cripps, K.C., and Mr. Danckwerts, K.C., for the appellant, they dismissed it, without calling upon the respondents' Counsel.

Winding-Up of the Automatic Gas-Lighter, Limited.

A petition presented by Mr. E. E. Jessel, the former Secretary, asking for the compulsory winding-up of the above-named Company, came before Mr. Justice Swinfen Eady last Tuesday. Mr. Luxmore stated that the petitioner was a creditor who had obtained judgment in the King's Bench Division for £158 10s. 10d. and costs, as damages for wrongful dismissal, and moneys paid on behalf of the Company. This judgment was still unsatisfied; and the petition alleged that the Company was insolvent, and had no goods or effects upon which execution could be levied. His Lordship made the usual compulsory order.

Liquidation of the Bens Gas Company, Limited.

The statutory meetings of creditors and contributories concerned in this liquidation took place at the London Bankruptcy Court last Thursday, before Mr. E. W. J. Saville, the Official Receiver for the Brighton district. The statement of affairs showed gross liabilities amounting to £1632, of which £406 was due to unsecured creditors. The other liabilities were £1102; making the total expected to rank against the estate for dividend amount to £1509. The assets were estimated to produce £766, from which £123 had to be deducted for the claims of preferential creditors payable in full, leaving the net assets at £642; thus showing a deficiency as regards creditors of £866. Among the principal creditors are the Davis Gas-Stove Company, Limited, for £31. With respect to the contributories, the total capital issued amounted to £3994, to which must be added the above-mentioned sum of £866; making the total deficiency as regards contributories £4860. The Official Receiver, in his report upon the case, stated that the Company was incorporated on Aug. 25, 1908, to acquire as a going concern the business of manufacturers of a gas-producing apparatus then being carried on under the style of the Bens Gas Company, Limited, and for other objects. Their insolvency was stated to be due to the loss of an action for damages; but in the Official Receiver's opinion it was probable that, while this was the immediate cause of the filing of the petition, the chief cause of the Company's failure was want of capital. The working expenses were exceedingly heavy, and the business was only kept going by means of loans. In the result, the matter was left in the hands of the Official Receiver; and at a meeting of contributories he was also appointed Liquidator.

MISCELLANEOUS NEWS.

EXAMINATIONS IN GAS ENGINEERING AND SUPPLY.

The City and Guilds Question Papers.

Readers are aware that the examinations in "Gas Manufacture," which have been for so many years conducted by the City and Guilds of London Institute, are now held on two branches of the subject—"Gas Engineering" and "Gas Supply." The Examiner for the former is Mr. Thomas Glover, of Norwich, who has succeeded in this capacity Mr. W. Doig Gibb, now the Chief Engineer of the South Metropolitan Gas Company; and for the latter, Mr. J. H. Brearley, of Longwood. The examinations in "Engineering" were held on the 16th inst.; and those in "Supply" last Saturday. The following were the questions set by Mr. Glover; the candidates being directed to confine themselves to one grade only, and not to attempt to answer more than eight of the numbered questions and only one of the alternative questions in the four hours allowed.

GAS ENGINEERING.

Honours Grade.

1. Describe any modern method, and name the principle on which the method is based, for preparing a coal, inferior as regards purity, for gas and coke making. [30 *marks.*]

2. Name some possible disadvantages which may follow the use of very small coal in the process of carbonization. How may these disadvantages be minimized? What would be the effect (*a*) on the gas, (*b*) on the residuals, and (*c*) on some parts of the carbonizing plant, of endeavouring to reduce, by the use of high temperatures, the period of carbonization while retaining heavy charges of very small coal? [35.]

3. How do the chemical and physical properties of a coal influence the methods adopted for its safe storage? Where a coal-store is limited in area for the quantity it is desired to store, what precautions would you consider it advisable to adopt when storing coal to a depth of 20 or 30 feet? [30.]

4. (*a*) Retorting plant is required for a maximum daily output of 2½ million cubic feet, and it has been decided to instal horizontally set retorts and machinery. State what number of settings of eight retorts you would consider it advisable to provide, and what saving in ground space, in square feet, could be effected by the adoption of four-tiered settings in place of three-tiered settings. State what you consider to be the advantages and disadvantages of both types of setting. [45.]

or, (*b*) Discuss the relative merits of retorts constructed vertically and worked intermittently, as compared with those worked with a continuous feed and a continuous withdrawal of coke. What theoretical and practical considerations are favourable to the continuous method of working? [45.]

5. (*a*) Give the approximate evaporative value in pounds of water per pound of the following fuels:—

(*a*) Coke breeze containing	12	p.c.	ash and	10	p.c.	water.
(*b*) Coke	8	,,		4	,,	
(*c*) Coal slack	15	,,		2	,,	
(*d*) Oil tar	0·2	,,		2	,,	
(*e*) Creosote oil	0	,,		0	,,	[35.]

or, (*b*) Give a description, with sketches (if possible), of any apparatus designed to consume heavy fluid hydrocarbons smokelessly for steam raising. [35.]

6. What would be the results on the quality of the producer gas, on the temperature of a setting, and on the brickwork lining of a furnace, of the following practice: (*a*) Feeding at too infrequent intervals; (*b*) omitting to spread the fuel evenly over the area of the grate; (*c*) omitting to clear the front of the furnace of accumulated refuse; (*d*) using a fractured feeding door or frame; and (*e*) using too much chimney draught? [40.]

7. A carburetted water-gas plant, designed for the production of high-grade gas, is required to produce a large volume of low-grade gas containing a small percentage of non-combustibles. State as fully as possible what alterations in the arrangement of the plant and operating conditions would be favourable to efficient working under the new requirements. [45.]

8. Discoloured sulphate of ammonia can be produced in several ways. Enumerate all the wrong conditions you know which lead to the production of discoloured sulphate, and state what alterations in the method of working would remedy the defects enumerated. [40.]

9. Describe any details of design and method of governing a gas-engine intended to overcome fluctuations in voltage where an engine is used for generating electric current. [35.]

10. Sketch, in plan, a general arrangement of purifiers for dealing with 2½ million cubic feet of coal gas per day, using oxide only. Draw a section of one of the boxes, giving chief measurements, and showing the method of fastening a rubber-jointed cover. [40.]

Ordinary Grade.

1. With what impurity in coal is arsenic likely to be associated, and how can this impurity be eliminated from the coal, or the proportion reduced? [30 *marks.*]

2. How is the temperature of a setting of retorts and working of the furnace affected by the quality of fuel used for firing? What percentage of ash in the fuel would you consider satisfactory, and how could the furnace be adapted to give high temperatures with fuel containing a high percentage of ash? [35.]

3. Sketch a front and side elevation of a self-sealing retort mouthpiece, and describe two methods of attaching the mouthpiece to the retort. What jointing material is used for the retort and mouthpiece and for the ascension-pipes? [30.]

4. Describe the essential difference between a "retort-house" and a "district" governor. In what position, relative to the retorts, would you fix the former, and why? [35.]

5. Describe the method of collecting and accurately testing the waste or flue gases from a gas-fired setting of retorts. From what part of the setting would you collect the sample of flue gases, and what precautions would you take to ensure accuracy? [40.]

6. What conditions in the process of carbonization are favourable to the production of the following: Ammonia cyanide, sulphuretted hydrogen, carbon bisulphide, and other sulphur compounds? Briefly describe the methods usually adopted for removing these impurities from the gas? [45.]

7. How would you test the specific gravity of tar, and how would you determine the percentage of water occluded? [40.]

8. Describe the Referees' sulphur test, and give the chemical formulæ on which the test is based. If the condensed liquor from 5 cubic feet of gas, measured at normal temperature and pressure, gives 10·6 grains of barium sulphate, how many grains of sulphur would 100 cubic feet of the gas contain? (Ba = 137; S = 32; O = 16.) [45.]

9. Give a simple sketch, with measurements, of the cup and grip of a telescopic gasholder. State what considerations regulate the depth of the cup when designing a gasholder? [40.]

10. Describe a method for automatically regulating the speed of an exhauster to maintain a steady vacuum with a varying volume of gas coming from the retorts and a varying resistance on the outlet. [45.]

GAS SUPPLY.

The following were the questions set by Mr. Brearley. In his instructions, he stated that in answering those marked with an asterisk sketches were to be used; and that, whenever possible, and pertinent to the question, sketches would also enhance the value of other answers. As in the "Gas Engineering" paper, not more than eight of the numbered questions, and only one of the alternative questions, were to be attempted in the four hours allowed.

Honours Grade.

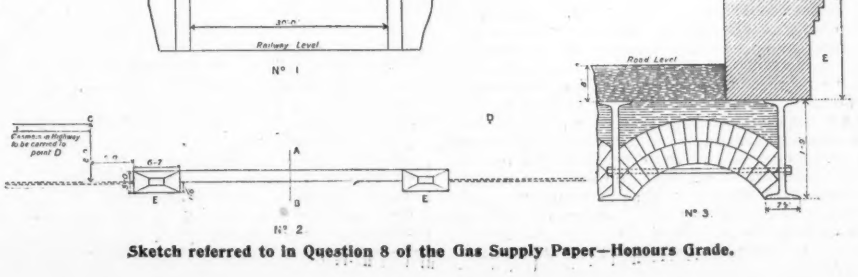
*1. (*a*) Describe fully the operation of fixing a service clamp or clamps to a high-pressure main, and give sketches of the type of clamp or clamps you would employ. What tools and fittings will be required to complete the service connection? [33 marks.]

or, *(*b*) Give sketch and description of a governor suitable for reducing the gas in a high-pressure main to normal pressure, and state the precautions necessary to ensure satisfactory working. [33.]

*2. Show, by means of sketch in elevation, a circulating gas water-heater with the connections to compensating tank and a hot-water radiator as used in heating public buildings. What fixing precautions are necessary when a complete installation is carried out? Give calculation of the gas required to heat, by hot-water system, the air in a hall of the following dimensions: Length 150 ft., width 60 ft., height to apex 25 ft., and to eaves 13 ft., assuming the rate of air change to be five times per hour and the average increased temperature required 10° Fahr. [45.]

3. (*a*) What tests should be employed to ascertain the thermal efficiency of gas cooking stoves and the hygienic effect upon the air of rooms? [30.]

or, (*b*) What are the advantages and disadvantages of flue pipes used in conjunction with gas cooking stoves? [30.]



Sketch referred to in Question 8 of the Gas Supply Paper—Honours Grade.

4. Assuming either of the two following types of gas compressors is equally convenient for the lighting of business premises, which would you prefer, and why: (*a*) gas driven rotary; (*b*) hydraulic? If a compressor of the last-named type failed, how would you proceed to ascertain the cause and to remedy the defect or defects? [39.]

5. (*a*) Give the equivalent of 54 inches of water pressure in pounds per square inch. (*b*) Define explosion and state the explosive limits of coal gas and air. (*c*) What is the law in reference to the diffusion of gases? [33.]

6. (*a*) How may the variations of flame temperature be measured? (*b*) State briefly a method of estimating radiant energy sensible as heat from a gas-fire. (*c*) Why is a highly aerated bunsen flame hotter than a less aerated one? [33.]

7. A 10 H.P. gas-engine requires overhauling. Describe in detail the operation of taking off, repairing, and replacing the valve box, gas, air, and exhaust valves, piston, and connecting rod. Why should a suction-gas engine have an auxiliary supply of town gas? [45.]

*8. The drawings [p. 253] are (1) elevation, (2) plan, and (3) enlarged section at AB of the parapet which surmounts a railway bridge. Show by sketches in plan and section how you would carry an 8-inch main from point C in the highway to point D and support it to the wall on side E of parapet. State, with reasons, what class of main you would employ, how expansion and contraction would be provided for, what specials would be necessary, and what tools and other materials would be required to complete the work. [45].

*9. (*a*) Give diagram showing the candle power at different angles below the horizontal of (*a*) any inverted burner, and (*b*) any upturned burner, each working at ordinary (say, 2 inches) pressure and consuming not more than 4 cubic feet of gas per hour. A simple sketch in sectional elevation of each burner must also be given. [39.]

or, (*b*) State generally how you would carry out lighting installations for any two of the following, having regard to the effect of artificial light on the eyesight: (*a*) Dining room, (*b*) brass finisher's workshop, (*c*) draper's shop window. What type of burners and globes or shades (if any) would you adopt in each case, and why? [39.]

10. (*a*) What quantity by volume of carbonic acid and what weight of water is produced by the combustion of 1000 cubic feet of average coal gas? What volume per hour of carbonic acid, and what weight per hour of water, is given off by the respiration of an adult under normal conditions, and how many British thermal units of heat does he give out? In what ways respectively do the products of coal gas and the respiration of human beings affect the atmosphere of dwelling rooms? [36.]

or, (*b*) Compare the relative fire risks of (*a*) town gas, (*b*) petrol air gas, (*c*) acetylene, (*d*) oil-lamps, and (*e*) electricity. State what you know of the general effect of each on insurance rates. [36.]

Ordinary Grade.

1. (*a*) Describe one form of leakage indicator suitable for locating escapes from gas-mains. A gas-main 200 yards long supplies 50 consumers and is connected to the distribution system at both ends; how would you ascertain the amount of leakage (if any) from same? [36 *marks*]

or, (*b*) Describe fully the operation of temporarily stopping the leakage from a split 8-inch main, permanent repairs being impossible for some days. [30.]

2. A five-light wet meter brought from a consumer's premises is found to be registering 25 per cent. slow; to what causes may this be ascribed? How would you proceed to put the meter into a thoroughly satisfactory condition and to certify the result of the work by testing on completion? [42.]

3. State, in percentages, the composition of the following alloys and the influence which each component has upon the finished alloy:—Brass, gunmetal or bronze, solder. In what way are two pieces of composition (lead) pipe joined by means of a blow-pipe, and what precautions have to be observed? [39.]

*4. (*a*) Why is it desirable to have pressures at consumers' premises regulated? Describe, with the aid of a sketch, one form of house-service governor. [36.]

or, (*b*) How would you proceed to prove the presence of a leakage in the fittings of a consumer; the leakage being too small to be readily indicated by the index of the meter? [30.]

5. A room with 2000 cubic feet of air space is lit with one inverted burner consuming 3 cubic feet of gas per hour. What quantity of air will be required for combustion, and what will be the proportion by volume of its chief constituents? Assuming the air of the room is changed twice per hour, what percentage will the air required by the burner bear to the total quantity passing through the room? [36.]

6. (*a*) In practice, bunsen flames with luminous tips are met with. Give three cases, explaining in each the cause and the remedy to be applied. [36.]

or, (*b*) How is efficiency best secured in the construction and use of (*a*) top burners of gas-cookers, and (*b*) gas-irons? State the proportion of primary air to gas in a well-constructed bunsen, and the essentials of a good flame. [39.]

*7. (*a*) State concisely the construction of ordinary types of (*a*) flat-flame, (*b*) argand, and (*c*) regenerative gas-burners. [33.]

or, (*b*) In the maintenance of incandescent burners (inverted and upturned), what are the points to be observed to secure a low mantle account without sacrificing efficiency? [36.]

8. Describe the operation of starting a gas-engine, including the regulation of gas into cylinder after engine has been "overhauled." Which form of ignition-tube do you consider most satisfactory, and why? [42.]

*9. Describe the following: (*a*) Anti-pulsator, (*b*) adjustable die-stock, (*c*) service-cleanser, (*d*) expansion gas-main joint (with sketch), (*e*) the operation of making a gas-main joint with lead wool. [40.]

*10. What are the common difficulties encountered in fixing brackets for outside shop suspension lamps and the conditions which govern the position of such lamps? Describe, with the aid of a sketch or sketches, the operation of attaching a shop suspension lamp to the masonry above a window casement, and state the tools and fittings required to complete the work. [45.]

BELFAST GAS-WORKS SCHEME.

Harbour Commissioners and the Twin Island Site.

At a Meeting of the Belfast Harbour Board last week, under the chairmanship of Mr. Robert Thompson, M.P., the minutes submitted by the Works Committee contained the following: "A deputation attended from the Gas and Law Committees of the Belfast Corporation. The Chairman of the Gas Committee (Mr. J. A. Doran) stated that the deputation were empowered to negotiate for the purchase of the plot of ground suggested as a site for the gas-works, lying between East Twin Island and the north end of the Musgrave Channel, and asked if the Commissioners are prepared to confirm the answers, including £750 per acre as the price of the ground, given to several queries of the Town Clerk. The Chairman informed the deputation that he believed the Commissioners, although not unanimous, might be taken as being favourable to the arrangement, subject to the satisfactory settlement of details; and, the deputation having retired, it was recommended that the Solicitor be instructed to prepare, in conjunction with the Town Solicitor, the necessary provisional agreement in the matter for the consideration of the Committee."

Mr. Herdman, in moving the adoption of the minutes, said the meeting between the representatives of the two bodies had been of the most harmonious and agreeable description; and he thought there was no doubt that the conference would lead to the completion of the business, to the satisfaction of all parties concerned. In making the offer of the ground to the Corporation, the Commissioners were largely actuated by public motives, as they felt that the price at which they were proposing to give it was far below its intrinsic value. But as it was a matter between two important public Boards, their feeling was to assist their friends of the Corporation in what was for the public good. It would be seen that the Solicitors were instructed to draw up the necessary documents; and then the matter would come before the Board again.

Mr. Andrews wished to enter his protest against the proposal. He objected to the site, both as a Harbour Commissioner and as a ratepayer. Not one of the members of the Board could form a remote idea as to how they might want to use the land in days to come. As a ratepayer, he objected strongly to the enormous amount of money it was proposed to spend on this Twin Island site. He thought the great majority of the ratepayers believed that the proper place for the extension of the gas-works was Ormeau Park. However, experts who were brought over declared for the Twin Island site. Still, the opinions of experts depended largely upon how the matter was placed before them. The foundations of the works on the Twin Island site would cost an enormous sum; and though it was not the province of the Harbour Commissioners to dictate to the Corporation how they should conduct their business, yet, speaking as a ratepayer, and not as a Commissioner, he thought they ought to use any influence they possessed with the Corporation to try and get them to reconsider this matter. He would like the opinion of the Board on the general principle whether they should give this land away for all time; and this seemed to be the principle submitted in the minutes.

Mr. Herdman said probably Mr. Andrews was aware that before the arrangement could be carried out the consent of Parliament legalizing the transfer would have to be obtained. As for Ormeau Park, surely Mr. Andrews had been long enough associated with the town to know that this question had been before the public for eighteen years. It was decided by the public eighteen years ago, when they declared in a very decisive way that they would not allow any portion of the park to be taken for gas-works. Moreover, since then the park had been specifically excluded by a vote of the Corporation, following upon a very significant expression of popular feeling. Mr. Andrews might take it from him that he would never see any extension of gas-works in Ormeau Park. As far as the desirability of the site was concerned, he thought they must admit that the Twin Island was the right place, when they had not only the officials of the works and the Corporation strongly in favour of it, but experts specially engaged to examine and report upon the sites equally strong in recommending it.

The Chairman said when the question first came before the Board, they looked at it from a commercial point of view; and they asked the Corporation what they thought was a fair price for the land. After the matter had been discussed at various meetings of the Council, and when the Board began to see that the Corporation thought seriously of the Twin Island site, they reconsidered the question of value, and came to the conclusion that it was their duty to reduce the price to a minimum. They were not animated by the motive of making money by the transaction, but by the desire to do that which would be for the public benefit. It should be made clear that they could not utilize a farthing of the money that they received either in connection with the docks or other harbour property. Their first duty after receiving it would be to buy harbour stock which was at present in the market to a similar extent, so as to wipe out the whole of the amount. The Ormeau Park site, to which Mr. Andrews had alluded, had been eliminated from consideration by the Corporation; and consequently the Board could not raise it. Even assuming that it was the best site, next to that the Twin Island site could not be ignored (after the opinion expressed by the experts) as the best, the most suitable, and the cheapest in the interests of the ratepayers.

The resolution was then put to the meeting and passed; Mr. Andrews dissenting.

Reference was made in the "Journal" a few weeks ago, to the departure made by the South African Lighting Association, Limited, in the manufacture of liquid (sp. gr. ·880) and cloudy ammonia; the claim made for the latter being that it is much stronger, cheaper, and of greater volume than that which is imported. The Association's Manager (Mr. W. Arnott) showed samples of these and other products on a very effectively arranged stand, of which he has sent us photographs, at the Port Elizabeth Agricultural Show, as well as at the Grahamstown Show, for each of which a gold medal has been awarded.

VERTICAL RETORTS

THE DESSAU SYSTEM OF INTERMITTENT CHARGING

GIVES BEST RESULTS

See "JOURNAL OF GAS LIGHTING," April 19, pages 168 and 169.

VERTICAL RETORT GAS IS SHOWN TO HAVE A HIGHER CALORIFIC VALUE AND A HIGHER ILLUMINATING POWER THAN GAS FROM OTHER RETORTS.

TABLE No. III (from "Journal of Gas Lighting," April 19, page 168).

System.	Place of Working.	Gas Made per Ton.	Illuminating Power by "Metropolitan" No. 2 Burner.	Calorific Power, B.Th.U. Gross.	Calorific Valuation Figure, B.Th.U. in the Gas per Ton of Coal Carbonized.
		Cubic Feet.	Candles.		
Woodall-Duckham continuous vertical retorts	Nine Elms, London	12,833	15·18	570·0	7,314,810
Glover-West ,, ,, ,, ...	St. Helens	13,102	15·56	565·4	7,407,870
,, ,, ,, ,, ...	,, ,,	12,435	16·19	574·2	7,140,180
,, ,, ,, ,, ...	,, ,,	12,145	15·22	567·6	6,893,500
Dessau intermittent ,, ,, ...	**Sunderland**	**12,465**	**16·84**	**615·12**	**7,667,470**
Glover, ,, chamber settings	Norwich	13,247	14·94	543·29	7,196,960

The above figures show that the DESSAU INTERMITTENT SYSTEM produces results superior to those obtained by any other system.

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THE WARSOP GAS INQUIRY.

Local Government Board Refuse the Order.

Reference was made in the "JOURNAL" for the 29th ult. to a Local Government Board inquiry extending over two days, which had been held at Warsop by Major C. E. NORTON, with regard to an application by the Urban District Council for a Provisional Order authorizing them to borrow £10,000 for the construction of gas-works. As was then stated, the scheme encountered great opposition. We are now in a position to give a fuller account of the proceedings than was at that time practicable—together with the intimation that the Local Government Board have refused to grant the Order.

The Council were represented by Mr. C. C. HUTCHINSON. Mr. L. MACASSEY opposed on behalf of the Staveley Coal and Iron Company; Mr. R. S. CLEASE for the Shirebrook and District Gas Company; and Mr. W. H. MOLE for the Great Central and Midland Railway Companies.

Mr. *J. Harrop White*, the Clerk to the Warsop Urban District Council, at the outset, said that, of the estimated population of 4400, 800 were in the area which was supplied by the Shirebrook and District Gas Company. The population of the district was likely to increase by reason of the sinking of another pit.

Mr. HUTCHINSON, in opening for the Council, remarked that the inquiry resulted from an application by that body to enable them to fulfil the duties that were cast upon them by section 161 of the Public Health Act. This dealt with the lighting of the streets. The second part of the section read: "Where there is not any company or person other than the urban authority authorized by, or in pursuance of, any Act of Parliament or any Order confirmed by Parliament to supply gas for public and private purposes, supplying gas within any part of the district of such authority, such authority may themselves undertake to supply gas for such purposes, or any of them, throughout the whole or any part of their district; and if there is any such company or person so supplying gas, but the limits of supply of such company or person include part only of the district, then the urban authority may themselves undertake to supply gas throughout any part of the district not included within such limits of supply." With regard to the part of the urban district which embraced the area in which five-sixths of the total population resided, the Local Authority, as there was no company supplying, might themselves undertake to furnish gas. At present a part of the district in respect to which the application was made was within the limits of supply of an adjoining gas authority—the Mansfield Corporation. Under the provisions of the Mansfield Gas Act, 1878, they might supply gas in an area embracing the parish of Warsop; but they could not supply gas beyond the district of Mansfield without the consent in writing of the Sanitary Authority in whose district gas was proposed to be supplied. This consent might be revoked upon payment by the Sanitary Authority to Mansfield of the sums expended by them in mains, &c. It was further provided that if at any time after the passing of the Act, upon six months' notice in writing being given to Mansfield of the desire to purchase the portion of the undertaking which was contained in their district, the Local Authority should obtain the consent of the Local Government Board to such purchase, and should apply to Parliament or the Board to purchase such portions of the undertaking and to supply gas within such district, then it should not be lawful for Mansfield to oppose. No statutory powers in regard to the supply of gas were necessary, because as soon as Warsop obtained the consent of the Local Government Board, they became endowed with all the powers of supply within the district that still remained in the area of the Mansfield Corporation. These powers were modified in some respects by the Mansfield Corporation Act of 1901. The proviso that Mansfield should not supply gas without the consent of the Local Authority was repealed; and, of course, with or without the consent of the Sanitary Authority of Warsop, Mansfield could have come in and supplied gas. But if Mansfield had covered the whole district, after six months' notice the urban district of Warsop could, in respect of this part of their area, have resumed the right of supply given them by the Public Health Act. Of course, this was the position that arose. The purchase from the Mansfield Corporation of so much of their undertaking as consisted of the rights and privileges of supplying this part of the Warsop urban district had been agreed to—the purchase money to be £300.

The INSPECTOR remarked that in clause 6 it was stated, among other things, that a Provisional Order was asked for to confirm an agreement with Mansfield for transfer of rights. In the Order, however, beyond mere reference in the recital, there was no allusion whatever made to the application to obtain the Local Government Board's consent.

Mr. HUTCHINSON replied that it was not necessary, because the provisions were already made by Parliament. It was for the Board to see whether the conditions laid down by Parliament in 1878 had been complied with. He had not dealt with one part of the area, because it would have been seen from the objections of a somewhat energetic, though alien, Company that part of the district had already come within the scope of supply of their profitable operations. In 1899, some promoters entered into a bargain with the Mansfield Corporation; purchasing from them for the sum of £500 such rights and privileges as the Corporation had not then exercised over the part of Warsop known as Warsop Vale, which comprised a small area of some 300 or 400 acres, and contained only one-sixth of the total population. This made no difference to the position of the Urban District Council in the present application; and, strictly speaking, he ventured to say that, if this were a proceeding before a Committee of Parliament, the alien Company, having themselves no interest in the part of Warsop over which the Council sought to exercise their own natural legal rights, would not be heard. It was proposed that borrowing powers should be applied for to the extent of £10,000. Though it was calculated that an expenditure of £8000 would be ample for the works, it would be necessary to keep £2000 in reserve for anything that might arise. It was estimated that 14-candle gas could be supplied for sale at 3s. 4d. or 3s. 6d. per 1000 cubic feet; and after payment of interest and sinking fund, there would be a margin left.

Mr. *White* then gave evidence as to the increase of population, and the further growth that would likely take place on the sinking of another colliery. Except Warsop Vale, the area was at present lighted by oil-lamps. A site of 2¼ acres had been secured for the erection of gas-works; the price paid being about £220. This land adjoined the Great Central Railway. In 1907, the Council, upon their initiative, proceeded to consider the question of supplying gas; and negotiations were entered into with Mansfield. These negotiations took place between the two bodies before there was any public intimation, or any knowledge acquired, of the fact that the Shirebrook Company intended to apply for powers over the area. There was no idea of forestalling that Company. No overtures were made by the Shirebrook Company to the Warsop Council. In the autumn of last year, the Company held a meeting in Warsop; and this was the first knowledge that the Council directly acquired as to the intention of the Company. This meeting resolved that it was desirable that there should be a better system of lighting at Warsop. It was not stated whether it should be gas or electricity. The Council were left to deal with the matter. The Council thereupon unanimously decided that they should themselves apply for an Order to enable them to supply gas.

Mr. CLEASE: What are you going to get for the £300?

Witness: We get the relinquishment by the Mansfield Corporation of their rights. We also get the support of Mansfield to this application, instead of their opposing, as they might have done.

Mr. CLEASE: A statutory authority cannot sell its right under Act of Parliament.

Mr. HUTCHINSON: The express right has been conferred by Act of Parliament.

Further questioned by Mr. CLEASE, witness said it was possible that a definite offer was made by the Shirebrook Company to supply this portion of Warsop at the same rate as the rest of their district.

Mr. HUTCHINSON: From my point of view, I do not know whether the Company have made an offer, or whether the Council knew about it. It does not matter to me one brass button.

Mr. MACASSEY: You know, of course, that under the Public Health Act a local authority are entitled to supply gas inside their district if there is no company, body, or person authorized to supply gas in the district, and, in fact, supplying. Now, section 161 of the Act states: "Where an urban authority may under this Act themselves undertake to supply gas for the whole or any part of their district, a Provisional Order authorizing a gas undertaking may be obtained by such authority under, and subject to, the provisions of the Gas and Water Works Facilities Act, 1870." Under this Act, a Provisional Order can only be granted by the Local Government Board authorizing any local authority to construct or to maintain works to manufacture gas in any district within which there is an existing company, corporation, body, or commissioners or persons empowered by Act of Parliament to construct such works. Am I right in thinking that the Mansfield Corporation are a corporation entitled to supply gas in your area of supply?

Witness: Yes.

Do you appreciate the fact that at the present moment there is no jurisdiction to the Local Government Board to make this Order?—We are advised that there is.

The INSPECTOR: The Local Government Board have directed an inquiry upon it.

Mr. MACASSEY: Of course, you will note my objection; and having made it, I would refer you to the West Houghton case, which was decided in 1877. It was a case where the Local Government Board made the Provisional Order under those circumstances, and where the Commissioners refused to proceed with the Order, on the ground that it was *ultra vires*. It is a leading case; and I put it very strongly that this Provisional Order cannot legally be granted.

Further cross-examined, witness said he knew the Staveley Company paid a considerable proportion of the total rates of the parish; but he did not know it was 65 per cent. The colliery was in the area at present supplied by the Shirebrook Gas Company; but he did not think it unfair to subject them to the liability of a rate-in-aid. Many of their workpeople lived in Warsop.

Mr. *J. W. Wigram*, estate agent to Sir Hugo Fitzherbert, Lord of the Manor of Warsop, and a large landowner, spoke as to the probability of a new colliery being sunk. He regarded the negotiations for this as being in a very advanced stage.

Mr. *John Renshaw*, a member of the Warsop Urban District Council, said the members were quite unanimous with regard to the application. It was their desire to have the supply of gas, or whatever the illuminant might be, in their own hands. It was not until lately that there had been a demand for gas in this part of the district. No representation whatever had been made to the Council on the subject, either by ratepayers or any other person. There had never been, in any way or shape, either directly or indirectly, any communication between the Shirebrook Gas Company and the Council. At the meeting which had been referred to, Mr. J. N. Derbyshire, as the representative of the Shirebrook Company, said the Company would be prepared, if the Mansfield Corporation, who had the right to supply gas to Warsop, would not do so, to apply to Parliament for an Act whereby the Company could supply Warsop with gas. The Company, seeing that their mains were already in the parish of Warsop, were quite prepared to supply the village. If the parish desired gas from them, then, as business men, terms and other matters could be discussed later. "But," continued Mr. Derbyshire, "we do not want to force ourselves upon you. We are here because we are close to your borders. If you want us, we are willing to come; but if you do not desire us, we shall stay where we are, and remain as good friends as now." On that occasion, the Chairman of the Council was asked to call a meeting at a later date; and this was done. It was then decided that the Council should adopt a better system of lighting; the choice of an illuminant being left to them. The meeting determined that the Council were the proper people to supply light in the district. He himself objected strongly to the introduction of any private company.

Mr. CLEASE: Before embarking on a large expenditure on a scheme like this, would it not have been wiser to lay the matter before the ratepayers publicly, showing them what the cost would be, what the estimated price would be, and what light they were going to get for it?

Witness: We did not see the necessity.

I put it to you that at the first meeting called there was a definite offer made, but not to the Council, that the Shirebrook Company would be prepared to supply this portion of Warsop at the same rate as they supplied the other part of the district?—Yes; they made a statement.

Mr. MACASSEY: Assuming that one-half of the total rateable value of the district is in the Shirebrook Company's area of supply, do you think it fair that the gas undertaking should be established for one-half of the district, and that the other half should be rated in respect of the undertaking from which they derive no benefit?

Witness: There are a lot of the Staveley Company's men living in this part of Warsop. They should receive some consideration, as well as those who live in Warsop Vale.

Mr. *Arthur Graham*, Gas Engineer and Manager to the Mansfield Corporation, who had been engaged by the Warsop Council as their expert for the purpose of carrying out the gas supply scheme, said the proposed site was satisfactory and convenient in every way. It was alongside the railway sidings; and the land was lower than the railway, so that the coal could be wheeled into the works without much expense. The site was rather too far away to provide a siding without an outlay of £250 or £300. For his calculations, he had taken a maximum of 8,000,000 cubic feet a year; and the cost of the works would be about £8050. He thought the Council would be able to sell gas remuneratively at 3s. 6d. per 1000 cubic feet by ordinary meter, and 4s. 2d. to slot consumers. He had made an estimate showing receipts of £1620 and an expenditure of £840—leaving a balance of about £780. This was based on ordinary gas sales of 2,250,000 cubic feet, and prepayment sales amounting to 4,400,000 feet, in addition to the public lighting. The revenue from ordinary sales he put at £394, from prepayment consumers at £917, and from street lamps at £100. Then there were meter-rents £15, and sales of residuals £200. They would supply 14-candle gas with the No. 2 burner, as against the 15-candle gas with a No. 1 burner of the Shirebrook Company. The net revenue he arrived at, after payment of all expenses and interest and sinking fund, was £185. He saw no reason why the revenue should not progress. A 14-candle gas on a No. 2 burner could be manufactured more cheaply than a 15-candle gas on a No. 1 burner. In his opinion, Warsop ought to have their own gas-works; and he did not see why Shirebrook should want to come in and take their rights away. If judiciously managed, an undertaking of the proposed size could be worked in the district without imposing any burden on the rates. They were successful in other places. In the first year the concern might not pay its way; but there was no reason why it should not afterwards do so. He had calculated that there would be some 150 ordinary, and 550 prepayment consumers. There had been no canvass; and these figures were simply taken from the population, and the number of houses, &c. There would be room on the site for extensions to meet an output of quite three times the 8,000,000 cubic feet he had mentioned. His estimated cost of the gas into the holder was 14d. per 1000 cubic feet.

Mr. MACASSEY: You are of opinion that an undertaking of this magnitude can be worked so as not to produce any burden upon the rates if judiciously managed. If not so managed, do you not agree that it is more than probable it will be a burden on the rates?

Witness: It might be for the first or second year; but after that it should not be.

Unless you had the portion of the parish of Shirebrook which is within the limits of the Shirebrook Company's area of supply as a district that can if necessary be rated in aid, would you as an Engineer advise the Warsop Council to undertake this scheme for the supply of the district?—Certainly not.

The INSPECTOR: Why did Mansfield cast away an area in which they could supply?

Witness: Because they are increasing so rapidly at home that they did not care a great deal to spend money on coming to Warsop.

Mr. *Corbet Woodall*, examined by Mr. CLEASE (for the Shirebrook Gas Company), was asked why Mansfield had never attempted to supply the Warsop area. He said there was a considerable difference in the levels, which would have meant a much higher initial pressure. The difference would also increase the cost of laying the mains. He did not think Parliament would have given Mansfield £300 for their rights. He was emphatically of opinion that it would not be of advantage to the Warsop consumers and ratepayers that the Local Authority should be authorized to supply gas under the provisions of this scheme or any similar scheme; but it would be an advantage to them if the district were supplied by the Shirebrook Company on the basis of the price they charged in their existing area. There was, so far as he could see, no prospect of Warsop ever having a consumption that would enable works of their own to pay; but with a company having a so much larger area as was open to the Shirebrook Company, the position was different. Again, while there was no reason why municipal bodies should not manage very well, a company usually managed better. The pecuniary interest attaching to the position of the Board of Directors was an important factor. The Shirebrook Company supplied within their own area at the present time about 25,000,000 cubic feet of gas per annum for lighting purposes; and the prices ranged from 2s. 9d. to 3s. 4d. per 1000 cubic feet. For power, the charge was from 1s. 6d. to 2s. 6d. In 1902, the Shirebrook Company were making 7,000,000 cubic feet of gas; and the capital was £16,463, or roughly £2400 per million feet. In eight years, the make had gone up to 25,000,000 cubic feet, while the capital had only increased to £26,128. Broadly speaking, the capital per million cubic feet made was now £1030; and it was a fair assumption that the Company's business would continue to grow. His figures as to the cost of production under the Council's scheme differed very largely from Mr. Graham's. Then he had taken a total capital expenditure of £13,000; and upon this, with a sale of gas of 5,000,000 cubic feet, at 4s. 9d. per 1000 cubic feet, it would be almost impossible for the concern to pay its way. The place would get a supply more quickly from the Shirebrook Company—in fact, before next winter. There was no doubt that there was a need for gas in Warsop; and the people would pay a big price for it, especially if the Local Authority had the supply. It was as wrong as could be that the gas consumer should have to pay an excessive price for gas in order that there might be money in hand for the rates.

Mr. CLEASE: In your estimate, have you allowed for the opposition to our Bill which, of course, will follow?

Witness: No; I have not.

The Shirebrook Company have not tried to bleed their district?—I think the history of this Company, and one or two others that seem to be controlled by the same group of gentlemen, is altogether creditable to them. I have always found the works in admirable order; and there has not been that grasping for immediate profits that would stand in the way of the development of the business. The capacity of the works is well in advance of both their own present needs and those of the part of Warsop that is not supplied.

Mr. HUTCHINSON: It is possible to find a local authority's undertaking which is well conducted?

Witness: Certainly. I said at the outset that I am not disposed to find fault with municipal management; but the tendency is to greater economy under the management of a company than of a corporation. I should say the works in some of the large towns—such, for instance, as Leicester and Birmingham—are admirably conducted by the Municipalities; and also some of the smaller ones.

Mr. CLEASE: If you had virgin soil here—no company, no local authority supplying—it is possible that you could devise a scheme for a local authority who wanted a supply, and a scheme which would be justifiable?

Witness: Yes.

But the Company are here supplying a part of this very parish, and the capital expenditure that the Local Authority would be put to in supplying the parish would amount to £3000 or £4000 more than the capital that the Company would have to spend if they were supplying this portion of the area. In these circumstances, are the Local Authority justified in attempting to supply?—That is for the ratepayers to decide; but I say emphatically that they are not justified, as long as they can get their gas cheaper under a company.

Will the ratepayers benefit if the Company carry out their proposal to supply at the price they are already charging, rather than that the Local Authority should carry out a scheme?—Certainly. The Council's proposal is one to get a very high price from the consumer for an idea.

Mr. *Graham* having been re-called to put in further information with regard to his estimate, said that he now brought out a total outlay of £10,750, including engineer's fees, contingencies, legal expenses, &c., in place of £10,000.

Mr. *R. G. Shadbolt*, Engineer and Manager of the Grantham Gas-Works, questioned by Mr. HUTCHINSON, said he thought, from his experience of works of the size of those proposed, gas could be fairly expected to cost the consumers about 3s. 4d. per 1000 cubic feet, when once the undertaking had got beyond the initial stage—say, after the first two full years' working. At the end of this time, it could be reasonably expected that, with the natural development of the district, the consumption of gas would run to 7,000,000 cubic feet. For such an undertaking as this, about £1250 per million cubic feet capacity of works would be a fair capital to take. There were varied classes of houses in the district—mostly cottages. But taking it as a whole, it would be a better yielding area than Warsop Vale. He had made a revenue estimate for the Council's works; and it showed that, after allowing for interest and sinking fund, there would be a small surplus of £137 per annum, reckoning the gas to be sold at 3s. 4d. to ordinary and 4s. to prepayment consumers.

Mr. HUTCHINSON: Looking at it as a matter of policy, do you think this is a wise step for the Council to take?

Witness: I consider the situation is such that the Council would be well advised to take advantage of the present opportunity to obtain the privilege of supplying gas to the district.

Mr. MACASSEY: You notice that this capital expenditure of £10,000 is to be incurred in respect of a district where the assessable value is only £6000—that is, excluding the portion of the parish in the area supplied by the Shirebrook Company. That is a pretty heavy capital expenditure?

Witness: It would be, if it were a speculative concern, but not in an established business.

Mr. *Sleight*, a Warsop Vale schoolmaster, and a member of the Urban District Council, said his house was supplied with gas by the Shirebrook Company; but, in his opinion, the supply was unsatisfactory. This was one of the main reasons why he was desirous of seeing the Council undertake a gas scheme. Whatever the cost, it would be preferable for Warsop to be supplied with gas by the Council, rather than that it should be furnished by the Company. He had frequently complained to the Shirebrook Company's Manager of the character of the supply.

The INSPECTOR said he would like to have another witness to deal with the question of the existing supply of gas, in order to corroborate Mr. Sleight.

Mr. *Renshaw* was thereupon called, and stated that the present supply was anything but satisfactory. In fact, from his own observation it was a thorough failure. He had seen the street-lamps with just a glimmer. They had complained as a Council to the Gas Manager many times about the inefficiency of the lighting at Warsop Vale; and in reply they were told that it was due to the interference of mischievous boys.

Mr. MACASSEY: Do you know that the Staveley Company have 175 houses supplied with gas in Warsop by the Shirebrook Company, and that the supply is perfectly satisfactory?

Witness: I do not. I know some people who have complained.

Mr. *J. N. Derbyshire*, the Chairman of the Shirebrook Gas Company, testified that they were able and willing to give a supply of gas as soon as they had power to do so; and they would give it to the district at the same price as was charged in the present area of supply. The Company had promoted a Bill to embrace the whole area. It included a portion of Bolsover, Cuckney, and Norton, and the remainder of Warsop. The only opposition so far was from Warsop. The Company's charge was 3s. 6d. per 1000 cubic feet maximum until the end of last year; it was now 3s. 4d. As to the consumption, in 1909 the ordinary consumers took 10,225,000 cubic feet, and the prepayment consumers 12,544,300 feet. The average per consumer was 6602 cubic feet. In Warsop Vale, the average was 5800 feet. The total authorized capital was £50,000, of which £25,000 was taken up. They had 2½ acres at present for the works; but an option had been secured on a further piece of ground.

They had not yet got a siding into the works; but the carting cost only 8d. per ton. The total number of consumers was 2072. Of these, 1897 had prepayment meters, and 175 ordinary. The average consumption per consumer might be 11,000 feet for the whole area, as the Great Central Railway took a large quantity of gas.

Mr. HUTCHINSON: You made a speech at Warsop, and said you did not want to force yourself upon them?

Witness: Perhaps "forcing" is a comparative term. My view of the matter is this. If we can supply gas in this district cheaper than the Council can supply it, then we think, when the people of Warsop really understand it, they will wish us to come. If we cannot prove we can supply it cheaper, we have no right to come.

I suppose you told them how cheaply you could supply them. You have not had much encouragement up to the present?—We had 75 per cent. of the ratepayers with us.

This completed the evidence.

Mr. CLEASE, addressing the Inspector, said that it was quite evident Mansfield never intended to exercise their powers of supply; so they might be eliminated from the discussion. He thought, too, that the Warsop Council would never have contemplated supplying, but for the fact that they heard the Company were in the field. This was not a good reason for giving a Provisional Order to a Local Authority who had failed in their duties. In one case, the money was to be found by the Local Authority; in the other, whether the Company lost or gained was not a matter for the community or the Local Government Board. He submitted that the Council had not made out their case; and the Order should not be granted.

Mr. MACASSEY contended that the Order was *ultra vires*. The Council had doubtless done much for the district; but it was felt that, from the circumstances of the case, they could not possibly operate the proposed gas undertaking at a profit. No evidence had been given of there being an urgent demand for a supply of gas in the district; but if it was thought that a supply was necessary, then obviously it could be better given by the Shirebrook Company than by the Council. The Staveley Company were satisfied with the supply furnished by the Company; and they said that if the supply of gas was given by the Council it would result in gross inequality, because the Council would charge the Staveley Company in respect of money borrowed for the undertaking. Here they had 75 per cent. of the total rateable value of the parish opposed to the Council's scheme to supply gas to a portion of the district representing only a quarter of the assessable value. It was not a case where the whole gas supply of the parish could be vested in the hands of the Council. The proper time to approach the matter would be when the Council could put forward a comprehensive scheme showing that they could better than anyone else supply the whole of the parish. The application was premature.

Mr. MOLE, after remarking that he did not propose to call evidence, said that for the year to Dec. 31, 1909, the Great Central Railway took considerably over 2,500,000 cubic feet of gas from the Shirebrook Company. They had no fault to find with the existing supply in Warsop Vale, either with regard to service or price. The Great Central and Midland Railway Companies felt strongly that, as a satisfactory supply could already be had on fair terms, it would not be right for the Council to embark on a scheme which would no doubt result in the levying of a rate-in-aid.

Mr. HUTCHINSON, in reply, argued that as soon as the Mansfield Corporation were dispossessed of their rights, either by agreeing to relinquish them or being paid, the rights they had held were automatically transferred to the Warsop Council. So soon as the consent of the Local Government Board was obtained, the process became effective. The Council had the confidence of the ratepayers, who had declared that they should be entrusted with the powers of lighting the district. Why should three big ratepayers, however large their financial interests, be allowed to dominate the express wishes of at least 700 of the others? As to the Shirebrook Company, he did not wish to say anything against them. But were they to say that, for the sake of them getting extra dividends, the Council's powers under the Public Health Act, in regard to establishing a gas undertaking, should be abrogated? If they were enabled to do this, a very dangerous precedent would be set.

After it was known that the Local Government Board had refused to grant the Order, a public meeting was convened by the Urban District Council; and thereat the following resolutions were unanimously carried: "That this meeting authorize the Warsop Urban District Council to oppose the Shirebrook Gas Company's Bill, with the object of getting the best protective clauses they can;" and "that the Council endeavour to enter into negotiations with the Staveley Coal and Iron Company, the Great Central Railway, the Mansfield Corporation, and all the opposing parties at the recent inquiry, with a view to enlisting their co-operation to secure a protective clause favourable to the future interests of the parish."

Water Scheme for Baku.—Among other public works which are to be carried out at Baku, for which the town authorities have raised a loan of 27 million roubles, is a scheme of water supply. It is proposed to bring the water from the springs at Shollar, about 120 miles from Baku. This water, which has undergone natural filtration, will be delivered untreated. The pumps required for the work will have to be imported, as Russia cannot supply them.

Portchester Water Supply.—The Admiralty officials in Portsmouth Dockyard have called upon the Fareham Rural District Council to furnish a sufficient and proper water supply to Portchester, which is within the Council's jurisdiction. The case for the Admiralty is that the coastguard well at Portchester is so foul that the water has become unfit for domestic use, as proved by analysis; and owing to this, at great inconvenience, a supply has had to be obtained from the Portsmouth Water Company's mains. The Council are, however, of opinion that the Company have no such right of service as that mentioned, and that the laying of a special main to Portchester could not be undertaken because of the great expense. The Fareham Council have resolved to undertake a separate analysis of the water from the well in question.

LONDON COUNTY COUNCIL AND THE NEW BURNER.

At the Meeting of the London County Council last Tuesday, the Public Control Committee presented a report on the Gas Companies (Standard Burner) Bill (No. 1). They pointed out that, as introduced, the Bill sought to provide, in the case of the Brentford and Wandsworth and Putney Gas Companies, and certain companies who do not supply gas in London, for the adoption of the "Metropolitan" argand burner No. 2 as a standard, in substitution for the various burners now in use for the official testing of the illuminating power of gas supplied by them. The Council on the 1st of March resolved that an amendment should be sought in the Bill, to provide that the gas supplied by the Wandsworth and Putney Company should in future be tested by the Council instead of by the Wandsworth Metropolitan Borough Council. Other amendments were proposed on behalf of the Council, the chief of which was one having for its object the setting up of a standard of calorific power. The Committee reported that the Wandsworth and Putney Gas Company and the Brentford Gas Company had withdrawn their names from the schedule to the Bill, and that it was not possible, therefore, to proceed with the Council's amendments. The report was received without comment.

MANCHESTER AND ITS GAS PROFITS.

Call for £1000 a Week in Aid of Rates.

Faced with an inevitable increase in the rates for the present year the Finance Committee of the Manchester City Council are bringing pressure to bear on the trading Committees to hand over out of profits a larger sum than has been decided upon. An intimation has also been made to the spending departments to revise their estimates; it being hoped by such means to keep the advance in rates down to 1d. instead of 3d., as at present shown by the accounts. As matters stand at present, there is a net decrease of £22,250 in the contributions from the trading Committees; and the increases in estimates of other departments total £120,400. The Gas Committee propose to allocate out of profits, in aid of the rates, a sum of £40,000, which is £10,000 less than was handed over last year; and the Tramways Committee have decided to reduce their contribution by £15,000. The Electricity Committee have resolved that their contribution shall be the same as before—viz., £12,000.

Last Friday a deputation from the Finance Committee waited upon the Gas Committee and asked that a larger sum than £40,000 should be handed over from the profits of the department. After having had the position explained to them by the Lord Mayor and members of the deputation, and following a long discussion on the points raised, a resolution was adopted by the Gas Committee that they could not see their way to handing over more than £40,000; the suggestion being made that the Electricity Committee should contribute a larger sum than £12,000.

The estimated profit for the year on the working of the Gas Department is put down at £43,000; but provision has to be made for a sum of £9000 expended on works for which there are no borrowing powers. A diminution in the receipts for the past year is attributed to the keen competition of the Electricity Committee. Interviewed on the subject, Alderman Gibson, the Chairman of the Gas Committee, said: "During the past two years, owing to the price of coal and the demands made by the Finance Committee, our reserve fund has been depleted. Last year we had a decrease of 1 per cent. in gas consumption, though there has been an increase of 4000 in the number of consumers. This 1 per cent. is equal to £9000 a year. In my opinion, this reduction arises from the keen competition of the Electricity Committee—a Committee which is permitted to borrow what it wants and when it wants, and to sell its product at whatever price it likes, without being compelled to pay anything towards the reduction of the rates. On the other hand, the Gas Committee is expected to take £1000 a week out of its profits in aid of rates, and is not able to sell gas at a price to allow it to compete fairly with the Electricity Committee. Upon the face of it, this seems to be very much like subsidizing one department and penalizing another. I think this is neither a wise policy nor a fair system of trading." Alderman Gibson added the information that since the gas undertaking became the property of the Corporation in 1844 a sum of £2,846,787 has been paid out of profits in relief of the rates.

The Electricity Committee's accounts for the year ended March 31 show a surplus of £35,220, of which £12,000 has been handed over. The Committee have decided that the balance of £23,220 shall be placed to a renewals account. During the past year, the sales exceeded all previous records, despite the fact that there had been a reduction of more than a million units of electricity used for traction purposes. On lighting there was an increase of more than half-a-million units; and on power sales, an increase of 5 millions.

ROCHDALE GAS PROFITS.

Larger Grant Required in Aid of the Rates.

At a Special Meeting of Rochdale Town Council next Thursday, the Finance Committee will submit a series of recommendations by which it is hoped to avoid any increase in the rates for the year. One of the proposals is that "an extra amount be taken from the gas and electricity profits." If the estimates of the various Committees were accepted as they stand at present, and the contributions from the Gas and Electricity Departments remain as fixed by the Committee, the rates would be at least 6d. in the pound more than they were last year; bringing them up to 8s. 3d. This is in consequence of the increased demands of the spending departments, and a deficit of £2990 on the water-works undertaking—the latter being £1741 more than it was twelve months ago.

On the past year's working of the gas undertaking there was a gross profit of £25,326, compared with £22,927 for the previous twelve

months. After deducting interest, sinking-fund charges, &c., there remains a net surplus of £13,664, out of which the Committee propose to give £8000 in relief of rates; placing the balance to reserve. Last year the Gas Committee handed over £10,000; and the lessened contribution equals a rate of 1½d. in the pound. The reason the Gas Committee have decided to contribute a smaller sum this year is because of their requirements in the way of new plant.

It should be explained that the large deficit on the water-works department is due to the necessary renewal of mains.

GAS, WATER, AND GENERAL INVESTMENT TRUST.

The Work of the New Board.

It may be remembered that some twelve months ago the Board of the Gas, Water, and General Investment Trust resigned in a body; and last June the following new Directors took their places: The Hon. Arthur Stanley, M.P. (Chairman), Mr. Claude E. S. Bishop, Mr. Percy Cross, Mr. Frederick Hill, and Mr. Michael B. Snell. At the general meeting last Thursday, these gentlemen presented their first annual report, which stated that they accepted office at a time when the credit of the Trust was at a very low ebb. Large loans from bankers and brokers, coupled with the unliquid state of the Trust's assets, greatly impeded the Directors in their efforts to place affairs on a more reasonable and businesslike footing. They had succeeded in reducing the loans to £111,319, as against £155,592 in the previous year, and the other outstanding liabilities to £40,359, as against £61,024. This reduction had been effected as far as possible by the sale of non-dividend bearing securities. The affairs of the United Railway and Trading Company, Limited, in which the Trust had embarked a sum of approximately £250,000, had occupied a considerable amount of attention, and negotiations were pending which might result in placing this Company on a much sounder footing. Since the end of the year, the liquidation of the City of Wellington Electric Light and Power Company had been completed; and a further return of 9s. 9d. per share would be received, which the Board considered most satisfactory. Had the revenue of the Trust been calculated on the same lines as in the previous year, there would have been a loss of £3989, as compared with £5528; but owing to the non-inclusion of a sum of £1818 received which had been placed to suspense account, the accounts showed a loss on the year of £5807, which had been deducted from the amount brought forward from last account, and left £2666 to be carried forward. The Board had devoted considerable time and attention to an investigation of the circumstances attending the acquisition by the Trust of certain of its largest investments. The opinion of eminent Counsel had been taken on the subject; and their advice had been adopted. They regretted to report the death of the Secretary (Mr. David Sluter), in whose place Mr. William Parker had been appointed.

In moving the adoption of the report and accounts, the Chairman said the new Board had taken office with a feeling of considerable responsibility, as it was a matter of public knowledge that the affairs of the Trust were not in a very good condition. He did not wish in any way to exaggerate; but it was a fact that this responsibility had not proved to be any less than they thought. Indeed, the position as they found it was every bit as bad as, if not worse than, they had been led to believe. He considered, however, there was a basis on which the Trust could be worked. It would take a great deal of trouble; but in course of time he thought they would be able to produce some satisfactory results. An enormous amount of money was invested in securities which did not bring in any return. This was a sort of dead-weight; and the Board were anxious as far as possible to get rid of the non-dividend paying securities, thereby diminishing the loan from the bank. The year before the present Directors took office, the Trust failed to earn the debenture interest by £5500; but they had since come appreciably nearer the point at which they would meet this charge. He hoped that by this time next year (when the present Board had had a full twelve months' working), if they were not entirely earning their debenture interest, they would at all events be very near doing so. Alluding to one portion of the report, he remarked that the Board had taken the opinion of the very best Counsel; and though he was not in a position just then to make a definite statement, he confidently hoped that before long this action would have borne some fruit. Before sitting down, the Chairman pointed out that it had been intended to proceed with the alteration of the name of the Trust; but some question had arisen with the authorities regarding the new title chosen. If, however, they could hit upon another name that would suit them, steps would at some future time be taken to make the change. He explained that the reason for desiring the alteration of the name was that, in the first place, the Trust was, he believed, started to deal mostly with gas and water securities. This, however, had now ceased to be the principal part of its business; and so the name was rather misleading.

After the motion had been seconded, several shareholders addressed the meeting. The first suggested that it would be better to form a new Trust to take over the assets of the present one. Another thought the question of name was not very important. What was required to secure good business was a good Board; and this they now had. Still on the subject of the name, a proprietor suggested that the change of title would offer a good opportunity for altering the Articles of Association so that the amount of money placed in any one investment should be limited. Yet another speaker expressed the opinion that, while changing the name, they should also re-arrange the capital and everything else connected with the Trust. The Chairman, in his reply, said he quite agreed that a reorganization of the Trust would be necessary at some time.

The report and accounts were unanimously adopted; and the other business of the meeting was then transacted.

Though no shareholder said as much, there must have been some in the room who thought it would have been better if the Trust had put more money into "gas" and "water," and less into "general" securities. Had a very much larger sum been invested, and retained, in sound gas and water undertakings, the affairs of the Trust could not very well have reached their present admittedly deplorable condition. Accompanying the report was a schedule of investments held by the Trust on Jan. 28 last; and from this it appeared that the holdings in gas and water companies' securities are not of an extensive character.

PRIMITIVA GAS COMPANY OF BUENOS AYRES, LIMITED.

Good Prospects for the Amalgamated Company.

The Annual General Meeting of the Company was held last Friday, at the River Plate House—Mr. A. E. Bowen (Chairman of the new amalgamated Company) in the chair.

The Secretary (Mr. J. M. Macmorran) read the notice convening the meeting.

The Solicitor next read a number of extraordinary resolutions to be submitted to the meeting, the first of which changes the name of the Company from the Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited, to the Primitiva Gas Company, Limited. The remaining resolutions referred to variations in the Articles of Association to make them conform with the requirements of the amalgamated Company.

The Chairman, in moving the adoption of the report and accounts, said he did not think it would be necessary for him to keep the shareholders very long, as, of course, they were only dealing with the accounts of the old Primitiva Company to Dec. 31 last; and, as the shareholders were aware, the situation changed radically on the 1st of January this year, inasmuch as on that day the Primitiva Company took over the working of the other two Companies—the River Plate and the Buenos Ayres (New) Gas Companies. Since then they had all been very busy getting the new organization into shape. As could be easily imagined, this was quite a big business, as all the staffs, both in London and in Buenos Ayres, had had to be re-arranged. Some of this re-arrangement was still pending; and therefore he did not propose to deal with it that day. But if he was fortunate enough to meet the shareholders next year, he should without doubt be able to give them full details and a satisfactory account of what had been done in this direction. Owing to the amalgamation, neither the Buenos Ayres (New), nor the River Plate Company would publish balance-sheets or reports, because their final dividends, for the year 1909, were provided for in the amalgamation with this Company. These dividends would be paid next day, at the same time that the Primitiva Company got their dividend. But the shareholders would, no doubt, like a few words about these Companies. They both did extremely well in 1909—better than was expected in face of the reduction which the Companies were all compelled to make in the selling prices of their gas. As from Jan. 1 this year, the three sets of figures had been put together; and he was very glad to be able to say that the surplus, after paying the dividends, was a substantial and satisfactory one. With regard to the business of the old Primitiva Company (he said "old" as it was the first Gas Company in Buenos Ayres, and was known as the old Company there), it would be seen that in the report it was stated that the demand for cooking stoves and heating apparatus continued to show a steady increase. It was hardly worth while troubling about figures this year, as next year they would be given for the amalgamated Company. As far as they had gone in the present year, business promised very well, although, owing to the partial failure of the crops on the other side, outward freights had been, and still were, very high. Although he did not like to be too sanguine, he was able to say that, in his opinion, this amalgamation was going to be a successful one, and that they would do quite as well as, perhaps better than, was anticipated when the shareholders were asked to agree to the amalgamation. The City of Buenos Ayres, in which they had virtually a monopoly of the gas business, continued to increase in size and in population. Business had been prosperous this year, though perhaps not so much so as in previous years, owing to the partial failure of the wheat and other crops; but there was really nothing to worry about, because, after all, the quantity of grain available for export was still very considerable. The political situation in Argentina was satisfactory and defined, inasmuch as the election for the renewal of the Chamber of Deputies, and for the election of the President, who was to take office in October next, passed off last month very satisfactorily. There was no disturbance of any kind; and the country seemed to be quite satisfied with the President and Vice-President elect. Politics, as they all knew to their cost, had a very strong bearing upon business prosperity, so the Directors were very glad to see that any chance of things going wrong in this direction in the Company's field of action was over for the present. Turning to the financial statements, on the right-hand side of the profit and loss account, the revenue showed an improvement over the previous year of £9912, at £107,325. The interest received from the Electric Company was £400 less, owing, of course, to the amortization. On the left-hand side, the interest paid on the debentures was also less by some £280; interests, discounts, &c., were £536 less than last year; the London office expenses, Directors' fees, &c., were up some £360, owing to an extra amount of cablegrams in connection with the amalgamation, to a slight increase in salaries, and to a small subscription given towards a memorial in commemoration of the Argentine Centenary. The income-tax was higher by some £600. This left a balance to be carried to the balance-sheet (£9398 more than last year) of £98,420. On the left-hand side of the balance-sheet, the capital authorized and issued was the same as last year; but the next balance-sheet would, of course, tell a very different story in this respect. The debentures were down by £8200; this amount having been redeemed during the year. The sundry creditors and credit balances showed an increase of £4755. On the other side, the capital cost of additions to works, &c., was more by £21,372, owing to the increases made during the year; the additions consisting principally of 15½ miles of mains. Stocks of coals, &c., were higher by £13,430; but this, of course, was another fluctuating item which varied from hour to hour. Investments were lower by £30,000, owing to sales made to provide capital for the extensions. Sundry debtors and debit balances were up £13,100; but this also was

incidental. The bills receivable were £24,000 better than last year, at £34,000; and the cash was down £1129. The next item—in a suspense account—was money spent before the end of the year on the demolition of the Retiro works, which, as the shareholders knew, had to be dismantled, and the land handed over to the Muncipality as soon as possible after June 30 this year. This would be dealt with in the accounts for the current year. Now, with regard to the profit and loss account, the Directors had to deal with an available total of £156,675, which was £20,500 better than last year. After deducting the debenture interest, London expenses, &c., and the preference dividend and interim dividend of 2s. 6d. per share paid on Oct. 31 last, there was a balance of £75,323, which was £30,000 more than last year. Out of this, it was proposed to pay the usual balance dividend of 4s. 6d. per share on the ordinary shares, making a total distribution of 7 per cent. for the year; and this, of course, was free of income-tax as usual. There was only one further item of interest with which he need trouble the shareholders, and that was that they proposed to pay the preference dividends in future on July 1 and Jan. 1 each year. It would be noticed that the carry-forward was £57,323 this year, against £26,903, so that they had a substantial amount in hand towards the payment of the preference dividend due on July 1.

Mr. H. E. JONES, in seconding, said a more eloquent comment on the position of the Company than any speech that could be made was the appreciation of the shares in the market since the amalgamation. The Directors had been very busy; and they had still a great deal of work before them. It was an important and not a light thing to have to demolish the Retiro works, and re-establish the plant elsewhere within twelve months.

The CHAIRMAN, replying to a shareholder who desired to know when the share certificates would be exchanged, said they were now being written out; and as soon as they were finished, they would be distributed. This, he thought, would be some time in May.

The motion was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. C. H. SANFORD, a final dividend was declared at the rate of 4s. 6d. per share, on the ordinary shares (free of income-tax), making 7 per cent. for the year.

The retiring Directors (Mr. H. E. Jones, Mr. C. H. Sanford, and Mr. W. W. Pnipps) were re-elected, as were also the Auditors (Messrs. G. A. Touche and Co.).

On the motion of the CHAIRMAN, seconded by Mr. J. MURRAY TULLOCH, the extraordinary resolutions referred to at the commencement of this report were unanimously passed.

The CHAIRMAN asked the shareholders to join with the Board in a vote of thanks to the London staff, the staff in Buenos Ayres, and especially to the Local Committee and the Chairman, Mr. S. Hale Pearson. In his remarks, he said he thought the shareholders could hardly fully realize the amount of work, trouble, and worry that had had to be met to bring about the amalgamation. He must say that Mr. Pearson had worked like a slave over it; and for that matter so had everybody else. But Mr. Pearson had had to bear the heat and burden of the day.

Mr. JONES said he was pleased to second the motion. They owed much to their Local Committee; and the delicate negotiations had been conducted by Mr. Pearson with extreme success. They were also fortunate in their Secretary, who had the assistance of the Secretary of the River Plate Company.

The motion was cordially agreed to.

The SECRETARY having responded,

Mr. SANFORD remarked that they could not separate without passing a vote of thanks to their Chairman; and he moved accordingly.

Mr. JAMES ANDERSON, in seconding, said he should like to include the remaining members of the Board. This was the first time they had had before them the entire Board; and the shareholders ought to express their gratification at the way the amalgamation had been carried out. It was, to say the least, an eloquent testimony to the great diplomatic skill of the members of the Board. He knew that it was a fairly easy business to amalgamate two companies; but it was a difficult thing to amalgamate three. The Board had done a great work. They had eliminated the element of competition; and they could now present a strong front against any local trouble that might arise.

The motion was heartily passed.

The CHAIRMAN, in acknowledging the vote on behalf of himself and his colleagues, said that it had indeed been a big job to get the amalgamation through; but he was sanguine it would be satisfactory and would produce good returns. There would, however, be no more amalgamations for him. It was too big a task.

Inspection of Oldham Corporation Gas and Water Accounts.—At the last meeting of the Lees Urban District Council, a resolution was read passed at a joint conference of representatives of District Councils recently held at Chadderton. In their opposition to the Oldham Corporation Bill last year, they obtained the insertion of a clause giving power to the out-townships to inspect the gas and water accounts. At the joint conference, a recommendation was made to appoint a chartered accountant as a joint inspector to undertake the work. The Council decided to acquiesce in the recommendation. The Crompton District Council came to a similar decision.

Trial of Inverted Gas-Burners in Islington.—At the last meeting of the Islington Borough Council, the Lighting Committee reported having considered a letter from the Gaslight and Coke Company calling attention to the greater efficiency and economy which may be obtained by substituting inverted for upright incandescent gas-burners in the public lamps, and stating that they would be prepared to convert 50 of the existing lamps, so that the Council might have an opportunity of observing the effect before entering into negotiations. The Company propose not to charge anything in respect of these trial lamps if those in the borough generally are afterwards fitted with inverted burners; but failing this, a charge of 15s. per lamp will be made. The Committee understand, however, that if this charge is made it will be covered by the saving that will have been effected by reason of the smaller quantity of gas consumed. The Committee have deemed it desirable to arrange with the Company to fix inverted burners as suggested; and they will report to the Council again at a later stage.

RADCLIFFE ELECTRICITY SUPPLY.

Encroachment by the Lancashire Electric Power Company.

Early in the present month, an inquiry was opened at Radcliffe, by Mr. Archibald Read, on behalf of the Board of Trade, in regard to an application made by the Lancashire Electric Power Company for a Provisional Order to enable them to supply electricity in the area of the Radcliffe Urban District Council. The Council have the monopoly of the supply of electricity in their district; and the Power Company, who erected a generating station just outside the boundary six years ago, are seeking to deprive them of it. They have latterly made many efforts to supply current in Radcliffe; but the Council have declined to allow them to enter into unrestricted competition with their municipal works. The application was opposed both by the Council and by the Radcliffe and Pilkington Gas Company. The inquiry extended over five days at Radcliffe; and it was resumed and concluded on the 16th inst., at the chambers of the Inspector in London.

The position taken up by the Council was explained by Mr. F. N. Keen, who represented them. He said the exact point submitted to the Inspector was not whether or not the Order the Power Company were asking for should be granted, but whether the consent of the Council ought to be dispensed with. He argued that, under the General Act of 1888, the Company should have the consent of the Local Authority before they could come into their district. The application was vague in character. The draft Order, as deposited, was in the ordinary form of an Order for general supply involving competition with the Local Authority in all branches of their business, whether for lighting, power, heating, or traction. He thought the arguments on behalf of the Council against the Order might be classified under four main heads. The first was that the Electric Lighting Acts did not warrant the making of an Order of this character—in other words, that they were in fact as well as in name electric "lighting" and not electric "power" Acts; the second was that the Order asked for would be contrary to the spirit and intention of the Private Acts of the Power Company; the third was that the application was contrary to general parliamentary practice and precedent; and the fourth was that there was no urgent demand for electricity for power in Radcliffe. He submitted that there were strong reasons in favour of a supply in bulk from Bury, and leaving the entire distribution in the hands of the Council, as opposed to the granting of an Order which would give the Company the right to distribute electricity in detail. In conclusion, he asked the Inspector to advise that the Board of Trade should not dispense with the Council's consent, and should trust them to supply the needs of the districts in such a way as they might think best, and allow them to continue to exercise the powers with which Parliament had thought fit to invest them.

The case for the Gas Company was submitted by Mr. Thomas, of the Parliamentary Bar (instructed by Messrs. Grundy, Son, and Co.). He said the Company objected to the Order applied for on two grounds—first on the ground of the competition which would be involved with their own undertaking; and, secondly, as ratepayers, and the largest in the district, who would, therefore, suffer more than any others through any financial injury which might result to the electrical undertaking of the Council. The Company had already been required by Parliament to face the competition of the electric light undertaking of the Council. They did not like it; but they recognized that gas and electricity had to compete, and they had to make the best of the competition, and meet it as best they could. But what they were asking to be protected from was the altogether new and unprecedented type of competition which would be set up if they had a third party coming with powers of distribution in the district, and producing such active competition—and, he ventured to submit, such unfair competition—both with the existing conductors of the electric light undertaking and the Company, as would result in undue cutting of prices, and considerable injury to the Company for whom he appeared. The Order they had to deal with was one for a general supply of electricity in the district; and he proposed to argue that it was only for the purposes of general supply that the procedure of a Provisional Order was properly applicable. But the promoters had indicated to the Inspector that it was not their wish to become suppliers of electricity generally in the district; and he was therefore content to argue upon what they asked for—viz., a limited Order which would exclude them from the provision of electrical energy for lighting purposes or for power purposes below 30 H.P. Even for these purposes, he argued, there would be substantial competition between the Power Company and the Gas Company. Gas was by no means out of the competition for power; it was still a thoroughly practicable and an economical way of driving. Counsel referred to certain evidence given on this point, and argued that the Power Company would be in a position, if they were so inclined, to bring the price down to an absolutely impossible figure for an undertaking such as that of the Council or of the Gas Company to compete with on anything like even terms. Interests had to be measured according to their relative importance; and the first was the interest of the ratepayers. This was the statutory position which governed the matter. Parliament and the Board of Trade had, he submitted, deprecated competition between power companies and local authorities. They had also made it the universal practice—of which the present application was the first really attempted exception—to make the rights of power companies dependent upon strictly parliamentary Statutes. A power company was relieved from the general law which made it necessary to charge equally to all customers in their area, and—what was still more important—such a company was relieved from the obligation of being purchasable by a local authority. In conclusion, Counsel contended that the applicants had not shown any substantial body of power users who were ready to take electricity, and argued that for purposes of cotton mills and paper making, which were some of the principal industrial purposes of the mills in the Radcliffe district, it was still an open question whether electricity was cheaper than steam, or steam cheaper than gas plant. There was no evidence before the Inspector to justify him in taking the view that the Council had abused the discretion Parliament had given them.

Replying, on behalf of the Power Company, to the legal arguments

against the application, Mr. C. H. Pickstone contended that the Company were properly applying for the Order under the powers Parliament had reserved to them in their Act of 1900. They were expressly authorized, in addition to furnishing a bulk supply, to sell in a general supply district, which was defined as that of an urban district council in precisely the same position as Radcliffe. Asked by the Inspector what he had to say as to any evidence of demand, Counsel replied that the inquiry was not to depend upon the small *minutiæ* of the business; it was a general broad estimate as to whether or not they had made out a demand. Unless they had been able to satisfy the Inspector that there was a demand, and no other reasonably available means of satisfying it except by the granting of the Order, then there was no ground for the application. But the demand was there; and the Radcliffe undertaking would not, either now or by any development that could be anticipated as possible, be able to meet it. He contended that if the development of industry was arrested by the absence of a cheap supply of electricity, it was not in the best interests of the ratepayers in the district.

At the close of the inquiry, the Inspector said he would give his decision as soon as possible.

UNPROFITABLE ELECTRIC LIGHTING IN DUBLIN.

The Right to Charge Deficiency in the Rates.

Readers of the "JOURNAL" are aware that the electricity supply undertaking of the Dublin Corporation is being carried on at a loss. Within the past two years, the Corporation have taken from the rates no less than £14,000 to make up for the loss; and prior to this the rates were drawn upon to the extent of upwards of £50,000. In view of these large levies, some of the citizens are asking whether the Corporation are acting within their legal rights in this respect, and whether there is no way to put a stop to their action. Mr. J. Picton Bradshaw recently addressed to the City Council a letter on the subject; and it brought from the Town Clerk a statement to the effect that, under section 54 of their Provisional Order, they have power to charge any deficiency upon the rates. This statement and the Town Clerk's reading of the Order have been challenged by Mr. Bradshaw, a letter by whom appeared in the "Dublin Evening Telegraph" last Tuesday. He complains that the whole of the section was not read, but only portions and the concluding words; the full conditions which must be complied with before the words came into force being suppressed. He contends that section 25 and Part I. of the Fourth Schedule of the Order, which regulates the price of current, must be read in conjunction with section 54; otherwise the interpretation is misleading and unfair. He advises every ratepayer to procure a copy of the Order, and see for himself how the Corporation have been and are now "safeguarding his interests" in this matter. He points out that the undertaking is purely and simply a trading concern, the profits of which should go to the reduction of the rates; and he submits that it should be run on up-to-date business lines.

After these introductory remarks, Mr. Bradshaw proceeds to direct attention to the portions of the Order specially bearing upon the subject. Section 25, together with Part I of the Fourth Schedule, regulates the price to be charged; while section 54 provides how the revenue thus obtained is to be applied. The Schedule sets forth that "where the Corporation charge any consumer by the actual amount of energy supplied to him, they shall be entitled to charge him at the following rate per quarter: For any amount up to 60 units £2, and for each unit over 60, 7d." This is clear; but how have the Corporation carried out their obligation? Not only have they ignored the £2 per quarter minimum charge, but have reduced the price from 7d. or 8d. per unit to an average charge of 2¾d.; thus selling under cost price. Mr. Bradshaw asks: "Is there a single member of the Corporation who would do this with his own business?"

Turning to section 54, Mr. Bradshaw points out that it specifies that all moneys received are to be applied in paying working expenses and the cost of maintaining the undertaking, in paying interest or dividends on moneys borrowed, in providing a sinking fund, and also a reserve fund amounting in the aggregate to one-tenth of the capital. With regard to the first matter, he expresses doubt as to the works having been properly maintained; while as to the reserve fund, which would amount to £60,000, it only stands at the absurd figure of £1332. The reserve is to be applicable to answer any deficit or any extraordinary claim at any time arising against the Corporation; and should this fund be reduced, it may be restored to the prescribed limit as often as such reduction happens. In face of this proviso, Mr. Bradshaw says: "Is there a business-like trading concern that would act as the Corporation have done? Compare Belfast. Notwithstanding that their works are more modern and their capital is about half that of Dublin, they have not only provided a reserve fund amounting to £42,000, but contributed to the relief of the rates last year no less a sum than £8282."

Dealing further with section 54, Mr. Bradshaw points out that the Corporation are to carry any surplus remaining in any one year to the credit of the rates for the improvement of the district, or to reduce the borrowed moneys for the electric undertaking. This, he says, they have completely ignored and disobeyed. Next comes the proviso—a most important one—to the effect that should this surplus in any year exceed 5 per cent. on the capital (in the case of Dublin this would mean some £30,000 in any one year), the Corporation are to make such a rateable reduction in the price of current as in their judgment will reduce the surplus to the maximum rate of profit. It is then, and only then, in the writer's opinion, that the Council can reduce the price, and that to such an extent as will, in their judgment, keep the profits only sufficient to provide the sums named. In other words, the profits are not to exceed a given sum, which is clearly defined.

Mr. Bradshaw now comes to the clause quoted by the Town Clerk: "Any deficiency of income in any year, when not answered out of the reserve fund, shall be charged and payable out of the local rate." He says from this it is clear that any deficit occurring after the maximum price is charged, and after depleting the reserve fund, can be chargeable to the rates. Could anything be clearer? The Corporation contend, however, that, even before they provide the reserve, properly provide for maintenance, or provide the 5 per cent. on the capital, they can, by beginning at the wrong end, first reduce the current under cost, and charge the loss to the ratepayers, many of whom cannot afford to use this luxury. He quite appreciates the fact that the Corporation have to compete with gas, and thinks they should do it, as long as it is fair competition. The more consumers there are, the better will the concern pay, and the cheaper can current be supplied. As the consumers increase and the consumption warrants it, reduce the price; but he holds that the Corporation have no power to reduce until this time arrives. Further, he understands they have offered a preferential rate of 3d. per unit for a term of five years to several large public institutions; and this he considers to be illegal.

He closes his letter with a few figures showing the results of conducting electricity supply undertakings elsewhere.

PUBLIC LIGHTING OF LONDONDERRY.

Gas v. Electricity.

The Manager and Secretary of the Londonderry Gas Company (Mr. R. J. Skinner) recently addressed a letter to the Town Clerk on the subject of the public lighting of the city, and it was subsequently published in the "Londonderry Sentinel." It appears that at a Local Government Board inquiry held a short time ago in regard to the raising of £10,000 for the electricity undertaking of the Corporation, the Electrical Engineer said current was being supplied to private consumers at less than the cost of production, and that the deficit was debited to the expenditure on public lighting. Mr. Skinner said he considered this grossly unfair to the Gas Company, they being among the largest ratepayers in the city, and also unfair to the citizens generally, as it benefited a favoured few at the expense of the vast majority. It was therefore something to which all had very good reason to take exception. The writer went on to refute a statement made by a member of the Council, that if the Corporation paid treble the price they were paying for the public lighting, they could not get the same light with gas. This, said Mr. Skinner, was not so; and, on behalf of the Gas Company, he made the following offer to the Corporation for the street lighting of the city.

There are in the city 185 electric arc lamps, costing £18 18s. per lamp per annum to maintain, or a total sum of £3496 10s.; and half the number are extinguished at midnight—often earlier. We are safe in assuming that the lamps are not lighted more than 10½ hours every day throughout the year; and allowing for those extinguished at midnight, or 5¼ hours, the average then becomes as follows: 93 lamps for 10½ hours; 92 lamps for 5¼ hours—an average of less than eight hours per day throughout the year. There is no appreciable difference in appearance and effect between the gas-lamp erected at the ferry landing-stage and the arc lamps in the streets; and upon lamps of a similar nature to this we will base our estimate and make our offer. We will undertake to supply gas, mantles, and globes, clean, light, and extinguish, keep in order generally, replace breakages (except from wanton damage), the same number of lamps as the existing arc lamps for a similar number of hours for the sum of £16 3s. 6d. per lamp per annum, which would mean a gross saving to the city of £2 14s. 6d. per lamp per annum, or a total saving for 185 lamps of £504 2s. 6d. This is no small sum; and it is worth consideration not only by the Corporation, but by the ratepayers generally.

In a post-script to his letter, Mr. Skinner said that in reckoning the number of electric lamps, no notice had been taken of "those that are always out."

Commenting upon the Company's offer, the "Sentinel" expressed the hope that it would receive the serious attention it deserved, as it would largely obviate the necessity of borrowing for an extension of the electric lighting, and save a further £400 or £500 a year to the ratepayers. The writer supported Mr. Skinner's protest against the policy of using money belonging to the ratepayers generally for the benefit of private light consumers, and for enabling the electric light to compete with gas. The article concluded as follows: "When it is realized that the acceptance of the offer would mean an immediate and permanent saving of 1½d. in the pound, the Corporation, in the interests of the citizens, should deal with it on its merits. The present public lighting system is ruinously expensive."

PUBLIC LIGHTING AT CHICHESTER.

Electricity v. Gas.

At the last Meeting of the Chichester City Council, the question of the public lighting came up in a report of the Council in committee which was presented for confirmation.

Confirmation of the proceedings in committee having been moved,

Alderman GIBBINGS inquired whether the tenders were exactly in accordance with the advertisement, and whether they were in order.

The TOWN CLERK (Mr. J. W. Loader Cooper), in reply, said the period of supply was "for one year or upwards." The Gas Company tendered for one, three, or five years, and the Electric Light Company for five years. So far as the period was concerned, both were in order. He had received a letter from the Gas Company; but the Council decided that, for the moment, at any rate, it should not be read.

Alderman GIBBINGS said he thought any ordinary man reading the terms of tenders would take it that he had to tender for one year, and to go on until he was stopped. He held no brief for the Gas Company—in fact, his feelings were entirely with the Electric Light Company on what he had heard had taken place. He thought, however, with regard to the period for tendering, that there should be no suggestion of unfairness.

Mr. C. FOWLER, in view of the divergence of opinion on the question before the Council, and since there was no urgency, moved, as

an amendment, that the matter be referred back to the Council in committee. He said he did this so that both Companies might tender on the one basis. They had had a long and interesting discussion on the matter, and more light was thrown upon it then than at any time before. They had a tender for five years; and it seemed to him, if economy was in their mind, that they would find just as much in gas, if the Company tendered for five years certain. At all events, they might give it a trial. They stood to lose nothing, but they stood to gain. Supposing they came to an arrangement with the Gas Company, there would be no upheaval of the streets, because everything was ready. A saving of £1000 a year was being effected at Victoria Station by the return to gas from electricity; and the men engaged at the station considered it a saving to their eyesight. At Brighton also they had reverted to gas, though the Railway Company were in a position to supply their own electricity. They found it cheaper to buy gas than to generate their own electricity. If the Electric Light Company's tender was accepted, who would pay for the upkeep of the electric lamps?

The TOWN CLERK: They do.

Mr. FOWLER quoted other places which he said had reverted to gas. Berlin had spent £350,000 in doing so; and Hastings had also gone back.

Alderman HOLT seconded the amendment; remarking that no harm would follow by putting the matter off for a month.

Mr. R. BOTTRILL did not think it would be businesslike to refer the question back now. He read a communication from the Gas Company, in which it was stated that the Company had not realized any profit from the public lighting; and therefore it was not expected they would get better terms than those shown in their tender. If they referred the matter back, the Gas Company would tender again, knowing the price tendered by the Electric Light Company; and this would be unfair.

Mr. W. BUTLER agreed with the previous speaker that it would be unfair to the Electric Light Company to allow the Gas Company to tender afresh.

Mr. H. S. AYLMORE also opposed the amendment. He said they had had the tenders before them, and the Council ought to decide forthwith which they should accept. If the matter was deferred, it would be to their disadvantage.

Mr. F. HILL said the main point was the extent of the saving to the ratepayers. There would be £80 a year saved upon the cost of lighting by accepting the tender of the Electric Light Company; and then, too, the new mains, when they were laid, would have to be taxed, which would mean further profit to the city. Moreover, the lamps would belong to the Council at the end of the five years. He had also been given to understand by the Manager of the Electric Light Company that if their tender was accepted, the price of current for ordinary house consumers would undoubtedly be reduced to about 4½d. per unit, which would also be a great benefit to the city.

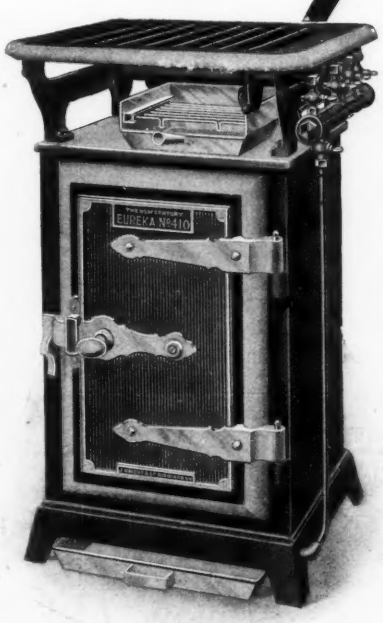
The amendment was then put and lost by 12 votes to 5, and the tender of the Electric Light Company accepted.

ELECTRICITY AND GAS SUPPLY AT FELIXSTOWE.

More Money Wanted—Reply to Mr. Napier Prentice's Circular.

Last Tuesday, Mr. H. R. Hooper, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry at Felixstowe relative to an application by the Urban District Council for sanction to borrow £4500 for the provision of additional plant in connection with the electricity supply undertaking. The Accountant to the Council (Mr. Arthur Griffiths) produced statistics with regard to the district; and Mr. Napier Prentice, the Engineer of the Suffolk Electric Supply Company, who carry on the works under the Council, gave evidence as to the progress of the Company—stating that a sum of £2250 would shortly be required for extensions to mains. The Inspector said, before dealing with the present loan, he must satisfy himself that the previous sanctions had been expended for items authorized by the Board. Mr. Griffiths explained that a lump sum of £8000 was paid to the Company for the purchase of the works during 1924. Since that time a further £6500 had been expended; but no steam plant, which appeared in the original application, had been put in. He gave details of this further expenditure, and said that the Engineer would explain in his evidence that they had an equivalent in generating power and storage. The Inspector, however, took exception to the action of the Council, as the periods for repayment of loans for accumulators, meters, &c., were much shorter than those for the works sanctioned by the Board. He would require the balance of the existing loan to be repaid and a short-period loan to be applied for. He said the Council had no right to obtain sanction of a loan for certain specific items, and spend the money on others. Mr. Griffiths pointed out the loss which would accrue to the ratepayers if the Board insisted upon the Inspector's suggestion, inasmuch as the amount received from the Suffolk Company would be the same, whereas the Council would have to pay a much larger sum for the repayment of the loan, in addition to the mortgagees' costs and those consequent upon the creation of a sinking fund. Mr. Prentice then gave details of the various engineering specifications, and mentioned that the Council were going to erect a ventilating shaft which would carry above the houses all the fumes coming from the gas-producer plant. Mr. S. Alexander (the Chairman of the Gas Company) complained that he owned property of the value of £1000 which could not be sold in consequence of the annoyance caused by the fumes. He prophesied that the only result of the shaft would be to spread the fumes over a larger area.

At the meeting of the Council next day, Mr. Clarke, in accordance with notice, asked the Chairman of the Lighting Committee whether the circular issued in the name of Mr. Napier Prentice, to which reference was made in the "JOURNAL" for the 5th inst. (p. 20), was the truth, and whether the Council had done their best under the circumstances. Mr. Cowles replied that all he could say was that of the two lighting tenders the Gas Company's was the better and safer to accept. The Suffolk Electricity Supply Company, moreover, could not carry



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the thing through without the assistance of the Council; and this would involve them in considerable capital expenditure beyond paying for the light. It must be remembered that the Council had not only to advance the capital that the Company required, but in a certain number of years they would have to pay 25 per cent. on all they had advanced, if they wanted to buy the business.

INVESTMENT OF GAS COMPANIES' RENEWAL FUNDS.

It will doubtless be remembered that a few weeks ago Mr. Justice Swinfen Eady had before him an action brought by a shareholder in the Worthing Gas Company to compel the Directors to invest their renewal fund in Government or other securities; and his Lordship ordered that this should be done. The question has been raised by correspondents in the "Accountant;" and in some comments in a recent issue the judgment in the Worthing case was cited as a complete answer to their inquiry. We give our contemporary's observations on the judgment.

It shows that, in the event of directors failing to invest instalments of renewal funds in accordance with the regulations of the company, any shareholder, no matter how small his holding may be, may successfully proceed against them by way of action, and obtain a declaration that the instalments so set aside must be invested, and the interest on the investments accumulated until such time as it is necessary to have recourse to the fund for the purpose of meeting expenditure in respect of renewals. To have held otherwise would have been to hold that the words providing for the investment of renewal instalments are meaningless; for if directors have a discretion to postpone investment until a convenient time occurs, they have for all practical purposes the right to postpone indefinitely.

We are, of course, not at all unmindful of the fact that the past few years have been singularly unprofitable to investors; that gilt-edged securities have been suffering more or less from a steady decline in values, which has, roughly speaking, entirely eaten up any appreciation of the funds arising from the accumulation of interest. But that, of course, does not dispose of the whole matter. Probably no Court would attempt to enforce such a declaration against the directors of a company until after the lapse of some reasonable time. It would never be seriously suggested that, whatever the market conditions might be, the investment of the funds of all gas companies must be effected on the 1st of January, or any other special date. But there is a broad distinction between waiting for the most suitable moment to purchase securities, having decided as a question of policy to do so at the earliest suitable date, and the avowed policy of the Directors of the Worthing Gaslight and Coke Company to use their renewal funds for purposes of extension, in order to keep their capital issues down to the lowest possible figure.

Clearly, the whole object of the Legislature in providing for the investment of these funds is to ensure their availability at short notice when the need arises. If, when the need arises, no moneys are available without having recourse to borrowing from the bank, or to a further issue of capital, with its attendant delays, it cannot be said that the moneys are in a readily available form. It might even be that they could not be raised at all without further statutory authority. While we thoroughly appreciate the wisdom of a policy which aims at keeping capital commitments as low as practicable, we must confess that it seems to us to be altogether wrong to divert what are virtually trust moneys ear-marked for the purpose of future renewals, and apply them to an altogether different purpose.

METROPOLITAN WATER BOARD.

New Supply Scheme Approved—Quinquennial Revaluation.

At the Meeting of the Metropolitan Water Board last Friday, the subject of the future water supply of the Metropolis, on which a report was presented by the Works and Stores Committee a few weeks ago, as recorded in the "JOURNAL" for the 15th ult. (p. 752), was again under consideration. According to the scheme submitted, provision is made for a supply of water by means of large reservoirs throughout the Thames Valley, sufficient to give, in 1916, a thirty days' supply for the population which it is estimated will then live in London. The scheme, which would not be completed in its entirety until twenty years hence, is intended to provide water for the needs of London up to 1941, at a cost of £6,273,710. The Finance Committee reported that to this amount must be added the sum of £15,000 to cover the cost of the promotion of the necessary Bill in Parliament, and that the capital outlay on ordinary main extensions and other operations of the Board, not included in the scheme, will probably amount to an additional £150,000 per annum. A total capital outlay of £10,938,710 is therefore contemplated between the years 1911 and 1941. After some discussion, the following recommendation was agreed to, with two dissentients: "That the Board do approve the scheme now submitted by the Works and Stores Committee for the future supply of the Metropolis by means of the construction of reservoirs in the valley of the River Thames in progressive stages." A resolution was also passed authorizing the Law and Parliamentary Committee to prepare a draft Bill to be introduced next session.

This year the quinquennial revaluation of the Metropolis takes place, and the Board have invited representatives of the London County Council and the Metropolitan rating authorities to attend a conference next month with regard to the rating of the Board's property. Five years ago a similar conference was held, and though no decision was arrived at as to the basis on which the water undertaking should be valued—this, it may be remembered, being subsequently decided by Quarter Sessions and the High Court—the exchange of views had beneficial results in bringing about agreements with many of the assessment authorities. Roughly speaking, the rateable value of the Board's property is £1,250,000.

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WOTTON-UNDER-EDGE WATER SUPPLY.

A New Scheme.

The quaint and picturesque town of Wotton-under-Edge, which is within the area of the Dursley Rural District Council, has just been furnished with an abundant supply of water of excellent quality, in accordance with a scheme prepared by Mr. H. J. Weaver.

The town has a population of about 3000; and the summer supply, derived more or less from surface springs, had, before the scheme was carried out, so diminished as to afford water for only from three to four hours' consumption per day in the autumn. After making a careful geological survey of the several valleys in the district, and testing the yield of the springs, the Engineer selected a spot for driving a short heading, and advised the Council to spend a sum not exceeding £250 in carrying out the work, and for testing the quantity of water obtainable from this source. The work was accordingly undertaken. The yield was taken for a period of twelve months; and it showed that a constant and equal quantity of water per day could be obtained, irrespective of the season of the year, with a tendency to neither increase nor decrease. Samples were taken and submitted to the County Analyst (Mr. George Embrey, F.I.C., F.C.S.), who reported that the waters were unusually pure, and contained less organic matter than any natural water he had hitherto examined. They were well suited for a public supply. The quantity of water obtainable and its quality being both most satisfactory, the Engineer was instructed to prepare the necessary plans, specifications, and quantities, for submission to the Local Government Board; and, after the usual inquiry by an Inspector of the Board, the scheme was approved, and sanction was given for obtaining a loan for carrying out the work—the term of repayment being extended over thirty years.

Briefly described, the new scheme consists in obtaining the water by means of headings driven into the hillside, just above an impervious stratum, at which point the lower springs of the district break out. From these headings the water is conveyed by gravitation, through conduits and cast-iron pipes, to a ferro-concrete sump, having a capacity of 35,000 gallons, whence it is raised to a height of 300 feet to a covered concrete service reservoir capable of holding 90,000 gallons. The contracts were divided into four: (1) Pipe laying and construction of conduit; (2) engine and gas-producer house; (3) pumping machinery; (4) ferro-concrete sump.

Contract No. 1 was carried out by Messrs. Beaven and Sons, Limited, of Gloucester, and consisted in driving headings into the hillside and the construction of a brick conduit set in cement mortar, and laid with open joints, the interstices of which are protected by broken stone laid 12 inches thick over the top and sides of the conduit. The bottom consists of a slit pipe invert, laid on a cement concrete foundation. The receiving chamber is accessible by means of a manhole, and is fitted with a copper weir to register the quantity of water flowing; and means of inspection are provided by manholes and lamp-eyes. The spigot and socket pumping main, which is 7 inches in diameter and of cast iron, is jointed with lead. It was tested to a hydraulic pressure of 500 feet head, and conveys the water which is pumped from the ferro-concrete sump to the service reservoir.

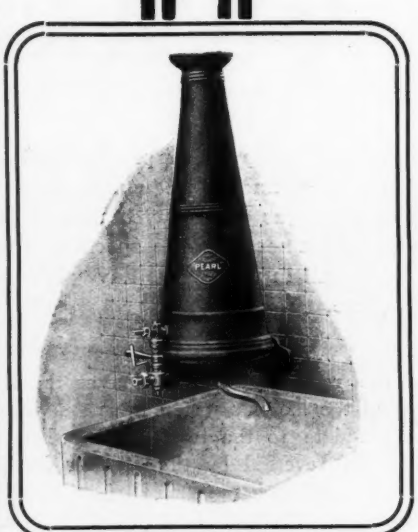
Contract No. 2 (for the engine-house) was carried out by Mr. A. J. Dolman, of Gloucester. Very great difficulty was experienced in securing a reliable foundation; the site having apparently at some time been a mill-pond. It therefore became necessary to drive piles under the whole of the footings to an average depth of 19 feet. The piles were of pitch pine, and 9 inches square. The concrete placed on the top of these piles was reinforced with steel bars. The building is of pressed bricks and Bath stone, laid in black mortar. The roof is covered with Broseley tiles, and the floor is of cement concrete.

Contract No. 3 was for the pumping machinery. The installation consists of a suction-gas engine and plant and a horizontal three-throw ram pump, capable of discharging 10,000 gallons of water per hour against a total head of about 300 feet. The engine is of the standard horizontal type, made by Messrs. Fielding and Platt, Limited, and is fitted with a single heavy fly-wheel and third bearing, and geared direct to the pumps by means of a clutch. The engine has valves and valve areas specially designed to give the best results when working with suction gas; the valves being arranged so that they may be readily examined or cleaned. The heavy fly-wheel is 7 feet in diameter, weighing about three tons; and the result is a set of engine and pumps running very steadily.

The gas-producing plant, which is also by Messrs. Fielding and Platt, is made suitable for using either anthracite coal or clean gas-works coke. Its leading feature is the regulation of the water supply in accordance with the load on the engine. There is no continuous steam-boiler, but the steam is made as gas is required; consequently there is no surplus of steam on light loads, and the calorific value of the gas is practically constant. The pumps were also manufactured by Messrs. Fielding and Platt, and are of the horizontal pattern, fitted with three rams, 8 inches in diameter. The speed of the pumps is 37 revolutions per minute. The engine uses 0·875 lb. of anthracite coal per brake horse power per hour at full load; and, approximately, for a week of 50 hours the consumption, including stand-by losses, would be three-quarters of a ton of anthracite.

Contract No 4—that for the ferro-concrete sump—was carried out by Messrs. Hobrough and Co., contractors for the Hennebique system of ferro-concrete. The sump, which has a capacity of 35,000 gallons, is circular in shape, and is constructed on the above-named system. It is wholly in the ground, and at such a level as to permit of the water from the springs gravitating to it. Thence it is pumped to the service reservoir. Messrs. Hobrough and Co. also carried out the pile-driving needed for the engine-house as well as the engine and pump bed foundations.

The Resident Engineers for the work during construction were Messrs. F. G. Church and A. M. Davies, from the office of the Consulting Engineer.



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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The fate of the Glasgow Gas Consolidation Bill has not yet been decided upon by the Corporation of Glasgow. The subject was before the Town Council on Thursday, when Mr. Battersby asked if the members of the Corporation would be furnished with a full report of the various alterations in the Bill by the Committee of the House of Commons, and if an opportunity would be given of discussing the Bill before further steps were taken in regard to it. Mr. J. Macfarlane, the Convener of the Parliamentary Bills Committee, replied that the revised Bill that passed the Committee had reached him that morning, and that he had called a meeting of the Parliamentary Bills Committee for Monday. The parliamentary recess would take place shortly, and there would be two or three weeks for the consideration of the Bill. When it reached the hands of the members, he hoped they would give it very careful attention, for there was much in it that would be advantageous to Glasgow. He would not like it to be rejected without due deliberation. The Corporation would certainly have an opportunity of discussing it.

For some time there have been incipient troubles in Falkirk, not with the men employed in the gas-works, for they have declared their content with their employment, but with some men who were dismissed in the middle and end of February, and who have asserted that they were dismissed because they were members of the Gas Workers and General Labourers' Union. The Gas Committee had the subject before them quite a number of times, and then, on the 12th inst., they adopted a resolution and reported: (1) That the electrician at the gas-works resigned his position verbally on Feb. 12, and gave one week's warning, and that he handed in to the gas office on the Monday following a written resignation, which the Manager ignored, as he had accepted the verbal resignation on the Saturday; (2) that, after consultation with the Convener and Vice-Convener, the Manager paid the electrician a week's wages on the Monday, and allowed him to go instead of working his week's warning; (3) that in the ordinary course of reducing the gas workers at this season of the year, four men were dismissed by the Gas Manager on Feb. 26, and he paid them one week's wages in lieu of warning; (4) that there was no evidence that the Gas Manager acted in any other way than in the interests of the gas-works; (5) that there was no evidence that the Manager was prejudiced against the men in consequence of their being Trade Unionists, but, on the other hand, the Committee accepted the Manager's assurance that he was not so prejudiced. In the Council, Bailie Boyle, the Convener of the Committee, moved approval of this report. He said the Committee sat for five-and-a-half-hours, and considered the subject in all its bearings; and they came to the conclusion that what the Manager did was right and proper in the circumstances. Mr. Muirhead moved that the subject be sent back to the Committee for consideration on the evidence which was laid before them. After discussion, the report of the Committee was adopted by seven votes to three.

The Gas Committee recommended that the Council advertise for an Assistant Gas Manager to succeed Mr. H. Rule. Treasurer Wallace moved that they do not, but that the present staff be rearranged and a junior clerk engaged. In support of the appointment, Bailie Boyle said it was obvious that they must have some one at the works able, in the absence of the Manager, to deal with certain eventualities which might arise, and also to do chemical analyses. It was true, as had been said in the Council, that they were not taking all they ought to do out of the works. The residual products might be very much better utilized; but if they made their staff useless, there could be no hope of this being done. The Council adopted the recommendation by seven votes to four.

A danger in connection with the use of prepayment gas-meters was disclosed by an unfortunate incident which took place in Dundee on the night between Saturday and Sunday last. On Sunday morning, a woman who lives in a common tenement in Wallace Street perceived a smell of gas in the entry to her dwelling. She traced the escape to the house of an elderly woman named Higgins, who, with her daughter and granddaughter, lived in the back apartment on the ground floor. Failing to get admission to this dwelling, the woman informed the neighbours; and one of them entered the place by the window. There was a strong odour of gas in the house. Mrs. Higgins was found dead in bed. The daughter was lying on the floor, and her child was in its cot, both unconscious. These were taken to the Infirmary and recovered. The prepayment meter was found to have been pulled off the shelf beside the window, on which it stood, and to be hanging by the connecting-pipes, which were half broken through, allowing the gas to escape. On the corner of the meter there was blood, and a penny was sticking in the slot. There was a slight cut on the head of the old woman. The surmise is that she had been in the act of putting a penny into the meter, and had either pulled this off the shelf, or it had fallen upon her, striking her on the head, and stunning her, but that she had been able to get into bed without seeking assistance.

The Grangemouth Town Council on Monday agreed to recommendations relating to proposed extensions at the Corporation gas-works. These included a boundary wall on the north and west sides of the works, at a cost of £160; a retort-bench, with settings of eights, which, with the excavations, foundations, and ironwork, will cost £420; a 75-feet chimney, with hoops and lightning conductor, at a cost of £193; four 18-feet square purifiers, with 12-inch pipes and connections, and a purifier-house, at a cost of £1300; a drain-pipe from the retort-house, at a cost of £40; and the telescoping of an 80 feet gasholder, at a cost of £700—a total of £2818. The telescoping of the holder was deferred till next year; making the outlay this year £2118. The number of retorts will be increased from 24 to 64. The capacity of the purifiers will be raised from 170,000 to 600,000 cubic feet of gas per day; and the gasholder, when telescoped, will be of 221,000 cubic feet capacity, as against 125,000 cubic feet at present.

RICHMOND'S "NEW CRUSADER," showing Fitter reversing hotplate.

FORWARD

BUILDERS of houses nowadays often provide kitchens of very limited area, and it frequently happens there is not room for a gas cooker with taps at the side. To avoid making it necessary to specially order a cooker with "tap-rail in front" we have produced a reversible hot-plate.

¶ Simply by the removal of the union at the side connection and the loosening of four screws which secure the hot-plate to the bridges, the whole of the top can be reversed by the gasfitter *in situ*, converting the gas cooker from taps at side to taps at front. CHANGE EFFECTED IN 5 MINUTES.

THE RICHMOND GAS STOVE & METER CO., LTD.,

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *April* 23.

There has been a quiet tone in the market all through the week, and the tendency of prices has been in favour of buyers; the month's export requirements being already for the most part covered. Home demand has been well sustained, but the bulk of it has not been enough to uphold the market. The closing quotations are, consequently, £12 per ton f.o.b. Hull, £12 2s. 6d. to £12 3s. 9d. per ton f.o.b. Liverpool, and £12 2s. 6d. per ton f.o.b. Leith. The forward position has not attracted attention, and no important business has transpired.

Nitrate of Soda.

This article is steady on spot Liverpool at 9s. 7½d. per cwt. for 95 per cent. and 9s. 10½d. for refined quality, less 2½ per cent.

Tar Products. LONDON, *April* 25.

The markets for tar products have been very firm during the week. Pitch is exceedingly strong, both for this season's and for forward delivery. Crude carbolic acid remains in about the same position, and makers are still not inclined to sell at present figures, except in one or two instances. Benzols and solvent naphtha are firm, and prices are fairly well maintained. In creosote, there are one or two inquiries; but prices are not altered.

The average values during the week were: Tar, 16s. 9d. to 20s. 9d., *ex* works. Pitch, London, 34s. to 35s.; east coast, 34s. to 34s. 6d.; west coast, 34s. to 35s. f.a.s. Mersey ports, 35s. f.o.b. others. Benzol, 90 per cent., casks included, London, 8d. to 8½d.; North, 8d.; 50-90 per cent., casks included, London and North, 9d. Toluol, casks included, London, 10½d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 4¼d. to 4⅜d.; North, 4¼d. to 4⅜d.; solvent naphtha, casks included, London, 1s. 3½d. to 1s. 4d.; North, 1s. 4d. to 1s. 6d.; heavy naphtha, casks included, London, 1s. to 1s. 1d.; North, 11d. to 1s. Creosote, in bulk, London, 2⅛d. to 2⅜d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

[We further learn that 37s. 6d. per ton has been paid in one important instance for business in pitch for this and next year, and that 40s. has also been paid for other large business for this year only—net, f.o.b. in the Thames. Also that, for delivery this year, 9d. per gallon, ordinary terms, has been paid for important business in 90 per cent. benzol.]

Sulphate of Ammonia.

The market for this article is certainly quiet, and manufacturers in all quarters have been more inclined to listen to lower prices. To-day actual Beckton is quoted at £12 5s. Outside makes, upon Beckton terms, are £11 15s. In Hull, £12 to £12 2s. 6d. is quoted; Liverpool, £12 2s. 6d. to £12 3s. 9d.; Leith, £12 5s. to £12 7s. 6d.; and Middlesbrough, £12 to £12 2s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

With a fuller output, the demand for coals is well maintained; but the prices are occasionally weaker. For best Northumbrian steam coals, from 11s. 6d. to 11s. 7½d. per ton f.o.b. is now quoted; second-class steams are 10s. 6d. to 11s.; and steam smalls from 6s. 6d. to 7s. 6d. The production is near that which is normal; but the opening out of the Baltic and Northern trades has enlarged the demand. In the gas coal trade, the home consumption is only moderate, as is usual at this season; but the exports are steady, and seem to be increasing. Durham gas coal varies in price according to quality. The usual classes are now about 10s. 3d. to 11s. per ton f.o.b.; while for "Wear specials," up to 11s. 6d. is quoted. There have been some negotiations as to coals for the London gas supply, and it is said that about 9s. 6d. per ton f.o.b. has been offered by the users. The exact position is not yet known, however, though some settlement is expected shortly—the sellers' quotations being higher. One or two small contracts have been settled for export, at rather better rates, and others are also pending. In the coke trade, the demand is steady; and as there is a lessened production of gas coke, this is firmer. The quotation for good gas coke is from 14s. 3d. to 14s. 6d. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

The market was quiet during the week, the inquiry for shipment having fallen off. The home demand for ell and splint was also easier, and prices were, in consequence, not so firm. For small sorts, prices were well maintained. The quotations are: Ell, 9s. 9d. to 10s. 3d. per ton f.o.b. Glasgow; splint, 10s. to 10s. 6d.; and steam, 10s. to 10s. 6d. The shipments for the week amounted to 315,292 tons—a decrease of 4241 tons upon the previous week, but an increase of 2207 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,397,725 tons—an increase of 676,677 tons upon the corresponding period.

The summer booklet of the Richmond Gas Stove and Meter Company, with a bright cover, printed in eight colours, is very pleasing and attractive. The articles described in its 48 inside pages are effectively illustrated; an art surface paper being used in printing. A page for memoranda, either by the consumer or by the show-room assistant when handing a booklet to a customer, is a commendable feature. The Company's "New Crusader" cooker, with reversible hot-plate, is specially dealt with at the commencement.

MOVEMENTS

ANOTHER improvement we have introduced this Season is a combination plate-rack, removable back and hood, which combination can be fixed to the cookers of any make complete, or the plate-rack alone without the hood. These accessories are bound to commend themselves to the housewife.

¶ The plate rack has two sides which clip on to cooker cornice and are held with a thumb screw rigidly in position. The rack holding plates is movable and can be swung back out of the way. The hood slides into grooves in the plate-rack. Thus the whole of the combination is built up to the complete structure, ALL PARTS BEING REMOVABLE.

The Inventors of the White Enamelled Crown Plate, Screwless Enamels, Removable and Screwless Gas Tap Rail, and NOW THE REVERSIBLE HOTPLATE, AND COMBINATION HOOD AND PLATE RACK.

Trade Union Funds.—A Bill presented by Mr. W. Johnson, and supported by Mr. Shackleton and other Labour Members, has been issued. It is entitled the Trade Union Law Amendment (No. 2) Bill; and it provides for the application of Trade Union funds to the maintenance of Members of Parliament and other public bodies. The clause on the subject is as follows: "A Trade Union, as defined by section 16 of the Trade Union Act Amendment Act, 1876, may, notwithstanding any of the provisions of the Trade Union Acts, 1871 and 1876, either acting by itself or in conjunction with any other Trade Union, association, or body, apply its funds for or towards the purpose of procuring the return and providing for the maintenance of members of Parliament, or public or local authority, or of any other public body, and may do such other acts as may be necessary to forward the interests of workmen by political action or otherwise."

Prepayment Meters at Morecambe.—On the minutes of the Gas Committee coming before the Morecambe Town Council, Mr. Dickinson drew attention to a resolution that no slot-meter be fixed in any house over £18 rateable value. He said he understood that users of slot-meters paid a higher price for gas than ordinary consumers. If this was so, why should not the occupier of a house over £18 be allowed to have one? He moved that the minute be referred back. Alderman Snowden asked what was the difference in the cost of slot-meters and ordinary meters. He did not want it to go forth that they were charging users of slot-meters considerably more for gas. Mr. Wright asked if the resolution was retrospective. Did they intend to take any slot-meters out of £18 houses? Mr. Gorton, in reply, said there might be one or two £18 houses that had slot-meters; but there were not many. Mostly, these meters were in cottages. They had sufficient ordinary meters to fit the whole town; and, in addition, they had 2000 slot-meters. A slot-meter cost about 30s.; but it would not supply sufficient gas for a large house, and when one of these meters had been fixed in a large house there had always been a complaint that the gas was poor. The greatest objection, however, was the capital expenditure involved. The difference between gas at 3s. 9d. per 1000 cubic feet per ordinary meter and the price by slot-meter was 5d., which was supposed to cover the capital charges. Mr. Saxton seconded the amendment; remarking that he could not see there was any difference in the capital expenditure between slot-meters and ordinary meters. If slot-meters were a convenience, why should they not be supplied to the higher-rated houses? If people preferred to pay the 5d. extra, and paid ready cash, it would be a benefit to the town. The amendment was rejected, and the minutes approved.

The Barrow-in-Furness Corporation Gas Department have placed with the Richmond Gas Stove and Meter Company the whole of their requirements for cookers during the next twelve months.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ASSISTANT-ENGINEER. No. 5228.
ENGINE MAN. Barnoldswick Gas and Water Department. Applications by May 3.
STOKER. Holmfirth Gas Company.

Agent Wanted. No. 5229.

Plant, &c. (Second Hand), for Sale.

EXHAUSTERS AND STEAM ENGINES, &c. Smethwick Gas Department.
PURIFIERS, &c. Sunbury Gas-Works.
STATION METER. R. Laidlaw and Son, Edinburgh.
TANK WAGGONS. Watson, Sowter, and Co., Derby.
WASHER, &c. Whitehouse's Executors, Ilkeston

Plant, &c. (Second-Hand), Wanted.

GAS METERS, STATION METER, &c. 154, c/o T. B. Browne's Advertising Offices.

Stocks and Shares.

CHIGWELL, &c., GAS COMPANY. May 3.
HARROW AND STANMORE GAS COMPANY. May 3.
HORLEY GAS COMPANY. May 3.
LEA BRIDGE GAS COMPANY. May 10.
SOUTHEND GAS COMPANY. May 3.
WALTHAM ABBEY, &c., GAS COMPANY. May 3.

TENDERS FOR

Benzol.

FOR EXPORT TO THE CONTINENT. No. 5226.

Coal and Cannel.

BRENTWOOD GAS COMPANY. Tenders by May 3.
CROMER GAS COMPANY. Tenders by May 7.
DEVONPORT GAS DEPARTMENT. Tenders by May 2.
EASTBOURNE GAS COMPANY. Tenders by May 3.
ELSECAR, WENTWORTH, AND HOYLAND GAS COMPANY, Tenders by May 11.
MOSSLEY GAS DEPARTMENT. Tenders by May 2.
PAIGNTON GAS COMPANY. Tenders by May 7.
RAMSGATE GAS AND WATER DEPARTMENT. Tenders by May 9.

Incandescent Goods.

CALCUTTA CORPORATION. Tenders by June 6.
DUBLIN CORPORATION. Tenders by April 30.

Lanterns, &c.

CALCUTTA CORPORATION. Tenders by June 6.
DUBLIN CORPORATION. Tenders by April 30.

Iron and Steel Work for Retort-House.

GUILDFORD GASLIGHT AND COKE COMPANY. Tenders by May 12.

Oxide (New and Spent).

DEVONPORT GAS DEPARTMENT. Tenders by April 30.

Pitch. No. 5230.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 230.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Apl. 1	5	Alliance & Dublin Ord.	83–85	–2	5 17 8
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
200,000	5	Oct. 28	7†	Bombay, Ltd.	6⅞–6⅞	..	5 5 8
40,000	5	,,	7†	Do. New, £4 paid	5–5¼	..	5 0 8
50,000	10	Feb. 25	15	Bourne-	29–30	..	5 0 0
311,810	10	,,	7	mouth Gas	16½–16¾	..	4 3 7
75,000	10	,,	6	and Water	15–15¼	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	251–254	..	4 18 5
300,000	,,		9⅜	Do. New	188–190	..	5 0 0
50,000	,,	Aug. 12	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	Dec. 29	4	Do. 4 p.c. Deb.	101–103	..	3 17 8
220,000	Stk	Mar. 16	11	Brighton & Hove Orig.	213–216	..	5 1 10
246,320	,,	,,	8	Do. A Ord. Stk.	152–155	..	5 3 3
469,000	27	Apl. 1	10⅝	British	44–45	..	4 14 8
109,000	Stk.	Feb. 25	6	Bromley, A 5 p.c.	118–120	+2	5 0 0
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90	+1	5 0 0
82,278	,,	,,	5⅜	Do. C 5 p.c.	105–107	+1	5 2 10
54,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	87–89	..	3 18 8
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	—	..	—
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	4–5	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6–7	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	49½–50½	..	5 18 10
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	86–88	..	5 2 3
157 150	Stk.	Feb. 25	5	Chester 5 p.c. Ord.	108–110	+2	4 10 11
1,513,280	Stk.	Feb. 25	5⅛	Commercial 4 p.c. Stk.	106–108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	103–105	..	4 15 3
475,000	,,	Dec. 29	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	98–100	..	5 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–140	..	5 0 0
492,270	Stk.	—	5½	Derby Con. Stk.	121–123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.	104–105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord.	96–98	..	5 2 0
486,093	10	Jan. 27	12	European, Ltd.	24½–24⅝	–⅛	4 17 0
354,060	10	,,	12	Do. £7 10s. paid.	18½–18⅝	–⅛	4 16 0
16,198,673	Stk.	Feb. 10	4⅝	Gas 4 p.c. Ord.	103¼–104⅛	–⅛	4 9 3
2,600,000	,,	,,	3⅛	light 3⅛ p.c. max.	88–90	..	3 17 9
4,002,235	,,	,,	4	and 4 p.c. Con. Pref.	104–106	..	3 15 6
4,531,706	,,	Dec. 29	3	Coke 3 p.c. Con. Deb.	81–93	..	3 12 3
258,740	Stk.	Mar. 16	5	Hastings & St. L. 3½ p.c.	93–95	..	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	117–119	..	5 9 3
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅛–18	..	6 2 3
131,070	Stk.	Mar. 16	7	Ilford A and C	145–147	..	4 15 3
65,783	,,	,,	5⅛	Do. B	108–110	..	5 0 0
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	100–102	..	3 18 5

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	8	Imperial Continental	181–183	..	4 7 5
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
195,242	Stk.	Mar. 16	6	Lea Bridge Ord. 5 p.c.	122–124	..	4 16 9
561,000	Stk.	Feb. 25	10	Liverpool United A.	223–224	..	4 9 3
718,100	,,	,,	7	Do. B	163¾–165¾	..	4 4 7
306,083	,,	Dec. 29	4	Do. Deb. Stk.	103–105	..	3 16 2
75,000	5	Nov. 26	6	Malta & Mediterranean.	4⅜–5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video. Ltd.	12⅜–13¼	..	5 5 8
1,775,892	Stk.	Feb. 25	4⅜	Newc'tle & G'tesh'd Con	104–105	..	4 3 4
529,435	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	91–93	..	3 15 3
55,940	10	Feb. 25	7	North Middlesex 7 p.c.	153–153⅜	..	5 1 10
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	141–143	..	5 11 11
60,000	5	Apl. 1	8	Ottoman, Ltd.	6–6¼	..	6 8 0
31,800	53	Feb. 25	13	Portsea Island A.	134–136	..	5 1 0
60,000	50	,,	13	Do. B.	126–128	..	5 1 7
100,000	50	,,	12	Do. C.	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	100–102	..	4 18 0
398,490	5	Oct. 28	7	Primitiva Ord.	7⅛–8	..	4 7 6
796,980	5	Jan. 27	5	Do. 5 p.c. Pref.	5 1/16–5 1/8	–1/16	4 9 11
488,903	100	Dec. 1	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
1,000,000	10	Oct. 14	8	River Plate Ord.	—	..	—
312,650	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
250,000	10	Apl. 1	9	San Paulo, Ltd.	15⅛–15⅜	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅞–12⅛	+⅛	4 18 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50½–51½	..	4 17 1
135,000	Stk.	Mch. 16	10	Sheffield A	232–234	..	4 5 5
209,984	,,	,,	10	Do. B	232–234	..	4 5 5
523,500	,,	,,	10	Do. C	232–234	..	4 5 5
70,000	10	Oct. 14	10	South African	12½–12¾	..	7 16 11
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	120–122	..	4 9 7
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
209,820	Stk.	Mar. 16	8	South Shields Con. Stk.	157–158	..	5 1 3
605,000	Stk.	Feb. 25	5⅜	S'th Suburb'n Ord. 5 p.c.	121–123	..	4 12 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	121–123	..	4 1 4
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122–124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Feb. 10	6⅞	Tottenham A 5 p.c.	133–135	..	5 1 9
453,940	,,	,,	5⅜	and B 3½ p.c.	113–115	..	4 13 6
149,470	,,	Dec. 29	4	Edmonton 4 p.c. Deb.	99–101	..	3 19 3
182,380	10	Dec. 29	8	Tuscan, Ltd.	9¼–9⅝	..	8 4 2
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p c max.	113–115	+1	4 0 11
255,636	Stk.	Feb. 25	6⅜	Wands- B 3½ p.c.	139–141	..	4 14 0
79,416	,,	Dec. 29	3	worth 3p.c. Deb. Stk.	74–76	..	3 28 11

† Next dividend will be at this rate.

Hull Water Profits and Rate Relief.—At the last meeting of the Hull Corporation Water Committee, a letter was read from the Hull Retail Grocers' Association calling attention to the desirability of revising the water charges to the general consumers instead of handing over the surplus profits to the relief of the rates, and thus unfairly benefiting some large ratepayers who do not use the water. The Mayor (Mr. H. Feldman) said the question had been fully considered on a former occasion, and the Committee came to the conclusion that it would not be wise to decrease the charges, which were as reasonable as those in other large towns. Alderman Robson thought it somewhat inconsistent that the North-Eastern Railway Company, who were their only competitors in supplying water to the town, should get (say) one-tenth of the grant of £12,000 from the water undertaking towards the relief of the rates, seeing that the money was contributed by the general ratepayers. The Mayor warned the Committee that if they reduced the charges their profits would vanish, and the water undertaking would become unprofitable. The communication was referred to a Committee.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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Correspondence invited.

LUX'S GAS PURIFYING MASS.
See Advertisement on p. 215.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

WARNER & VAN DER BIESEN,
ZWOLLE, HOLLAND.
DIGGERS AND SUPPLIERS OF THE
FINEST DUTCH BOG-ORE.
(Natural Oxide of Iron.)
Best Percentages. For lowest Quotations to any Port, Station, or direct into Works, please apply to—
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FIDDES-ALDRIDGE
SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
See Advertisement, April 12, p. IV. of Centre.
ALDRIDGE AND RANKEN,
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Telegrams: "MOTORPATHY, LONDON." Telephone: 5118 WESTMINSTER.

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Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

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HIGH PRESSURE LIGHTING SPECIALIST.
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It is also used for the enrichment of Gas.
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J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, SUNDERLAND, and WAKEFIELD.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

KRAMERS AND AARTS WATER-GAS PLANT.
K. & A. WATER-GAS COMPANY, LTD.
39, VICTORIA STREET, S.W.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SULPHURIC ACID.
SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

OXIDE OF IRON.
(NATURAL)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
BALE & CHURCH,
5, CROOKED LANE, LONDON, E.

SULPHURIC ACID.
SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.
with which is amalgamated WM. PEARCE & SONS, LTD.
86, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

"NUGEPE" GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 25, BRIDGE END, LEEDS.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 213 Holborn.

AMMONIA.
Consumers in any form are invited to correspond with CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.

OXIDE OF IRON
(NATURAL)
FOR GAS PURIFICATION.
NEW WESTBURY IRON COMPANY, LTD.
WESTBURY, WILTS.

TAR WANTED.
Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, **THOMAS HORROCKS,**
Albert Chemical Works, BRADFORD,
MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

GAS TAR wanted, Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

GAS OILS.

MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and 11, Old Hall Street, Liverpool.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.

See Illustrated Advertisement, April 5, p. 8.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

CAST-IRON Pipes. Spigot and Socket or Flanged. Special Quality—9 feet or 12 feet Lengths. When buying, Write us.
A. Lowcock, Limited, Shrewsbury.

AMMONIA Waste Liquor Disposal. Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
Telegrams: Saturators, Bolton. Telephone 0848.

"HALLITE" Asbestos High-Pressure Sheeting.
Hallite Douglas, Limited, 106, Leadenhall Street, London, E.C.

SATURATORS made or Repaired. Reasonable Terms (workmanship guaranteed) by a 30 Years' Saturator Maker (Labour and Plant only), at per Hour or Contract. Saturators improved. Perfect Mixing and Noiseless.
Davies, General Chemical Plumber and Leadburner, 117, Gallaway Road, Shepherd's Bush, W.

APPOINTMENTS.—Ambitious Men of of Parts invited to write—
HERBERT GREATOREX,
APPLICATION SPECIALIST,
BEECHWOOD, MATLOCK.
Specimen of many results:—
"Have got the job. Quite a good start.
To you the credit is due, and I think your
fee the best Investment I ever made."
BUSINESS IS REVIVING. WRITE NOW.

WANTED, for a 180-Million Feet Works in the South, an ASSISTANT to the ENGINEER. Must have had good all-round Experience in a Medium-Sized Works, and be a good Draughtsman and Chemist. Salary, £200 per Annum.
Apply, by letter only, stating Age, Experience, and present Salary, with *Copies* of not more than Three recent Testimonials, to No. 5228, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by the Holmfirth Gas Com- pany, Yorks., a thoroughly reliable Married Man as STOKER. Eight Hours Summer, Twelve Hours Three Months of Winter. Wages, 37s. 6d. per week. To a Steady Man used to Shovel Charging, Boiler, Exhauster, and Engines, the Situation would be permanent.
Apply, with Testimonials, to A. E. Buckley, Gas-Works, Holmfirth.

AGENT GESUCHT.

DEUTSCHE Leistungsfähige Fabrik von Invertbrennern (Innen-& Aussenlampen), bestes Fabrikat, sucht in England gut eingeführten Agenten.
Briefe Exped. No. 5229, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(Gas and Water Department.)

WANTED, by the above Council, a competent Man to TAKE CHARGE OF THE ENGINES at the Pumping Station.
Wages to commence at 30s. per week.
Applications to be in Candidates' own Handwriting, stating Age, and Experience, together with *copies* of Three recent Testimonials, to be forwarded to the Chairman of the Gas and Water Committee, Town Hall, Barnoldswick, not later than the 3rd of May, 1910.

J. W. Thompson,
Engineer and Manager.

Town Hall, Barnoldswick,
April 18, 1910.

PITCH WANTED—11,500 Tons. This Season's Delivery.
Replies, *stating prices* f.o.b. English Ports, also Quantities, to No. 5230, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Set of Four Purifiers, about 30 feet Square, with Valve and Connections.
Full Particulars with Lowest Price to Firth Blakeley, Sons, and Co., Ltd., Thornhill, Dewsbury.

WANTED—Four Second-Hand Small ROTARY GAS METERS. Capacities, 160,000, to 170,000 cubic feet each per 24 Hours, with Flanged Connections. One Second-Hand STATION GAS-METER, capacity 900,000 to 1,000,000 cubic ft. per 24 Hours. The Meters to be in good Working Condition.
Full Particulars as to the Condition, Price, and where the Meters can be seen, to be sent to Box 154 care of T. B. Browne's Advertising Offices, 163, Queen Victoria Street, London.

FOR SALE—Good Order, One Washer by Kirkham, Hulett, and Chandler, 8-inch Connections, and Engine to drive it. All good.
Address, Whitehouse's Executors, Ilkeston.

FOR SALE—Four Purifiers, 8 feet Square, with 8-inch Valves and Connections and Lifting Gear Complete. All in Good Working Order. Can be seen at work.
Full Particulars from S. Bark, Engineer and Manager, Gas-Works, Sunbury-on-Thames.

TANK Waggons for Sale, 8 to 12 Tons, for Tar, Liquor, &c.
Apply to Watson, Sowter, and Co., 25, Iron Gate, Derby.

GASHOLDERS—Splendid 45 feet dia- meter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

FOR SALE—A Station Meter in Square Cast-Iron Case, to pass 60,000 Cubic Feet of Gas per Hour. Can be fitted with New Drum if necessary and made equal to a New Meter. A low Price will be accepted.
Address R. Laidlaw and Son (Edinburgh), Limited, London and Edinburgh.

COUNTY BOROUGH OF SMETHWICK.
(Gas Department.)

SECOND-HAND EXHAUSTERS AND STEAM-ENGINE.

THE Gas Committee of the Corporation of Smethwick have for DISPOSAL Two DONKIN EXHAUSTERS, with STEAM-ENGINES Combined, including Disc Valves, nominal capacity 40,000 and 60,000 Cubic Feet per hour respectively; also a HORIZONTAL HIGH-PRESSURE STEAM-ENGINE 14-inch Bore, 20-inch Stroke, to work at 80 lbs. Steam-Pressure.
For an Immediate Sale, a low Price will be taken.
The Plant can be seen at the Gas-Works, Rabone Lane, at work during the next Two or Three Weeks; and any further Particulars can be obtained on Application to Mr. Vincent Hughes, Engineer, at the Gas-Works.

W. J. Sturges,
Secretary.

Gas Department, Council House,
Smethwick, April 12, 1910.

BRENTWOOD GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Brentwood Gas Company are prepared to receive TENDERS for the Supply of 6000 Tons of Yorkshire Silkstone GAS COAL, to be delivered into the Company's Siding on the Main Line of the Great Eastern Railway, Free of all Charges, in such Quantities as may be required during the Year commencing the 1st of July next.
Forms of Tender are not supplied.
The Directors do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Tender for Coal," to be sent, on or before the 3rd day of May next, addressed to the undersigned.

Henry A. Hall,
Secretary.

St. James' Road, Brentwood,
Essex, April 22, 1910.

THE Directors of the Elsecar, Went- worth, and Hoyland Gas Company invite TENDERS for the Supply of 3000 Tons (more or less) of Best Screened GAS COAL or NUTS, to be delivered at Elsecar Station (Great Central Railway) during the Year ending the 30th of June 1911, at such times and in such Quantities as required by the Manager.
Tenders to be delivered by the 11th of May, addressed to the Chairman, 94, King Street, Hoyland, endorsed "Tender for Coal."

Albert F. Hall,
Secretary.

Hoyland, near Barnsley,
April 23, 1910.

BOROUGH OF MOSSLEY.

THE Gas Committee of the Borough of Mossley invite TENDERS for the Supply of Screened GAS COAL.
Specifications and Forms of Tender may be obtained from the undersigned.
Sealed Tenders, endorsed "Gas Coal," and addressed to the Chairman of the Gas Committee, Gas-Works, Mossley, must be delivered not later than the first post on Monday morning, May 2, 1910.

James Taylor,
Engineer and Manager.

Gas-Works, Mossley,
April 18, 1910.

EASTBOURNE GAS COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the Supply of 30,000 Tons of Clean, Dry, Unscreened, Fresh-Wrought GAS COALS, delivered at Eastbourne Railway Station during the Year ending Aug. 31, 1911.
The Deliveries to be in about equal Monthly Quantities.
Payment in Cash Monthly.
Particulars and Forms of Contract may be obtained from the Secretary.
The Directors do not bind themselves to accept the lowest or any Tender.
Tenders, sealed and endorsed "Tender for Coals," to be addressed to the Chairman of the Company, at the Offices, 10, Sussex Gardens, Eastbourne, on or before May 3, next.

By order,
James S. Garrard,
Secretary.

April 11, 1910.

CORPORATION OF CALCUTTA.

THE Corporation of Calcutta invite TENDERS for Three Thousand COPPER LANTERNS suitable for Single Light Inverted Incandescent Gas-Burners.
It is absolutely necessary that the Lanterns should be insect proof; but the means of making them so is left to the discretion of the Manufacturer.
The Lanterns should not be painted, as this will be done locally.
Tenders are to be submitted for shipment c.i.f. direct to Calcutta; payment being made when the Lanterns have been passed and accepted in Calcutta.
Samples of what it is proposed to Supply should be sent with each Tender; but Firms who have already submitted Samples through Messrs. Mansfield and Sons, of Liverpool, need not again submit Samples.
Tenderers must state the time for Delivery from receipt of Order.
Tenders should reach the Corporation, addressed to the Vice-Chairman, Calcutta Corporation, Calcutta, India, not later than the 6th of June, 1910.

P. N. Mookerjee,
Secretary to the Corporation.

Municipal Office, Calcutta,
March 23, 1910.

CORPORATION OF CALCUTTA.

THE Corporation of Calcutta invite TENDERS for a total number of 10,000 INCANDESCENT GAS BURNERS, to consume (*a*) 3 Cubic Feet Per Hour, (*b*) 3½ Cubic Feet per Hour, (*c*) 4 Cubic Feet Per Hour, and (*d*) 5 Cubic Feet Per Hour, at 20-10ths pressure. The Burners must have arrangements by which the Nipples can be easily and quickly changed to make the burner suit different pressures; but 20-10ths will be the minimum pressure on which they will be used. The Air Inlet should not be adjustable, as it is found that the Lamp Lighters and Cleaners are apt to interfere with adjustable openings. The quality of the Gas is 14-Candle Power when tested with the No. 2 "Metropolitan" burner; and it is of rather Low Calorific Value.
Tenderers should submit two Samples each of (*a*), (*b*), (*c*), and (*d*); one being of the Inverted Type and the other the Erect Type of Burner, but each must be submitted Complete with all necessary Glass-Ware, &c., and with One Dozen Assorted Nipples suitable for each Burner, together with One Dozen suitable Mantles for each.
Tenderers should state their price per 100 for spare Nipples of any size; the size of each Nipple being stamped legibly on it by a number representing its diameter in $\frac{1}{1000}$'s of an inch. The Samples will all be tested carefully for Consumption and Illuminating Power; and the Order will be given to the Firm supplying the Sample which gives the greatest efficiency per foot of gas consumed.
Tenders are to be submitted for shipment c.i.f. direct to Calcutta; Payment being made after receipt in Calcutta.
Tenderers must state the time they require to deliver the total number of 10,000 Burners from the date of order to proceed with the work. The successful Tenderer will be informed by Cable; and must then proceed to carry out the Contract. Samples, however, should be sent direct to Calcutta.
Tenderers must guarantee that the Burners supplied will be in every way exactly as per Sample.
Sealed Tenders should reach the Corporation, addressed to the Vice-Chairman, Calcutta Corporation, Calcutta, India, not later than the 6th of June, 1910.

P. N. Mookerjee,
Secretary to the Corporation.

Municipal Office, Calcutta,
March 23, 1910.

BENZOL.

To Collieries having Bye-Product Recovery Coke-Ovens, or to Tar-Works capable of delivering for Export to the Continent 3000 Tons per Annum (more or less) of 90 per cent. Commercial Benzol under Contract covering a number of Years.

Offers are invited from Firms only who are *bonâ-fide* in a Position to enter into a Contract for the above quantity.

Address, in first instance, No. 5226, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CORPORATION OF DUBLIN.

TENDERS FOR SUPPLIES, FOR THE PUBLIC LIGHTING DEPARTMENT (INCANDESCENT GOODS, SQUARE LANTERNS, WROUGHT-IRON CRADLES, &c.).

THE Corporation of Dublin invite TENDERS for the above for a period of Twelve Months to end on the 31st of March, 1911.

Specification, with General Conditions and Form of Tender, may be had on Application at the Office of the City Engineer, on payment of the sum of One Shilling for each Form.

Tenders must be addressed to the Chairman of the Supplies Committee, and delivered to me not later than Saturday, the 30th day of April, 1910.

The Committee do not bind themselves to accept the lowest or any Tender.

HENRY CAMPBELL,
Town Clerk.

Town Clerk's Office, City Hall,
Dublin, April 18, 1910.

CROMER, NORFOLK.

TENDERS FOR COAL.

THE Directors of the Cromer Gas Company are prepared to receive TENDERS, from Colliery Proprietors only, for the Supply of about 2000 Tons of First-Class GAS COAL (in the proportions of two-thirds of Coal and one third of Nuts) to be delivered at the Company's Siding (Midland and Great Northern Railway Station), Cromer, between the 1st of August next and the 30th of June, 1911. Weight given to be stated.

Deliveries to be made in such Quantities and at such times as may be required by the Company.

Payment, net Cash Monthly.

Sealed Tenders, endorsed "Tender for Coal," to be sent to the undersigned on or before the 7th day of May next.

Forms of Tender are not supplied.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
P. E. HANSELL,
Secretary.

Cromer, April 23, 1910.

GUILDFORD GASLIGHT AND COKE COMPANY.

IRON AND STEEL WORK FOR NEW RETORT-HOUSE.

THE Directors of the above Company invite TENDERS for the Supply, Delivery, and Erection of the IRON and STEEL WORK required for their new Retort-House at the Gas-Works, Onslow Street, Guildford.

Specification, Blue Prints, and further Particulars can be obtained, on deposit of One Guinea (which will not be returned), from Mr. P. C. Cleasby, Gas-Works, Guildford.

Tenders, sealed and endorsed "Tender for Ironwork," addressed to the Chairman of this Company, to be delivered at these Offices not later than Ten a.m. on Thursday, the 12th of May, 1910.

The Directors do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM TITLEY,
Secretary.

Gas Offices, Onslow Street,
Guildford, April 27, 1910.

COUNTY BOROUGH OF DEVONPORT.
(GAS DEPARTMENT.)

THE Gas Committee of the Devonport Corporation are prepared to receive TENDERS for the Supply of 25,000 Tons of GAS COAL, to be delivered in such Quantities as may from time to time be determined previous to June 30, 1911.

The Coal is to be delivered c.i.f. at Tamar Wharf; and Forms of Tender and Specification may be obtained from the undersigned.

The Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Gas Coal," and addressed to R. J. Fittall, Esq., Town Clerk, Devonport, are to be delivered at the Town Clerk's Office on or before Monday, May 2, 1910.

W. P. TERVET,
Engineer and Manager.

Gas-Works, Devonport.

COUNTY BOROUGH OF DEVONPORT.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of 300 Tons of New OXIDE to be delivered c.i.f. Tamar Wharf, or f.o.r. Keyham Station (Great Western Railway).

Forms of Tender and Specification may be obtained from the undersigned.

TENDERS are also invited for the Purchase of 350 to 400 Tons of SPENT OXIDE. Samples of this may be obtained on Application.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders to be sent in not later than April 30, addressed to R. J. Fittall, Esq., Town Clerk, Devonport, endorsed "Tender for Oxide."

W. P. TERVET,
Engineer and Manager.

Gas-Works, Devonport.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the Supply of 5000 Tons of best approved GAS COALS, to be delivered in such Quantities and at such times as may be required, and to weigh 20 cwt. to the Ton over the Gas Company's Weigh Bridge.

Tenders to be accompanied by Practical Working Analysis, stating the Price of Coal delivered at Paignton Station, Great Western Railway, free of all Charges.

Forms of Tender are not supplied.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained from Mr. C. G. Dawson only.

Sealed Tenders, endorsed "Tender for Coal," specifying the description and quality of Coal, to be sent on or before the 7th day of May next addressed to the undersigned at the Gas Offices, 1A, Victoria Street, Paignton.

F. W. PUDDICOMBE,
Secretary.

Paignton, April 14, 1910.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for 22,000, 44,000, and 66,000 Tons (One, Two, and Three Years' Supply respectively) of Best Quality Soft Caking and Gas Producing Screened Durham or other COAL, delivered free into Carts on the Quay at Ramsgate Harbour, or free into the Stores at the Gas-Works.

Deliveries to be in Monthly Quantities, as set forth in the printed Particulars, and are to commence as from Aug. 1, 1910. A distinct Price to be named for each quantity.

Tenders to be sent in not later than Noon on Monday, May 9, 1910, addressed to the Chairman of the Gas and Water Committee, Gas and Water Offices, Boundary Road, Ramsgate, endorsed "Coals."

The Committee do not bind themselves to accept the lowest or any Tender.

Full Particulars and Form of Tender on Application to the undersigned.

WM. THOMSON,
Engineer and Manager.

Gas and Water Offices,
Ramsgate, April, 1910.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.
(IN VOLUNTARY LIQUIDATION.)

NOTICE is Hereby Given, that, in accordance with the Terms of the Agreement with the Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited, dated Dec. 2, 1909, a Final Dividend at the rate of Eight Shillings per Share (free of Income-Tax) will be payable on and after the 23rd inst.; making, with the Interim Dividend paid on the 21st of October last, 7 per cent. for the Year 1909.

And NOTICE IS FURTHER GIVEN, to Holders of Share Warrants to Bearer of this Company, that Coupon No. 40 will be paid by the Company's Bankers, The Union of London and Smiths Bank, Limited, 50, Cornhill, E.C., on and after the 23rd inst., at the rate of Eight Shillings per Coupon.

By order,
F. C. IM THURN,
ROSS PINSENT.
} Liquidators.

1, East India Avenue, E.C.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Executors of the late H. J. Rydon, Esq.

GAS STOCKS AND SHARES,
of the CAPITAL VALUE of upwards of £10,000
IN THE
HARROW AND STANMORE GAS COMPANY,
SOUTHEND GAS COMPANY,
CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY,
HORLEY DISTRICT GAS COMPANY,
WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 3, at Two o'clock, in Lots.

Particulars of H. W. RYDON, Esq., Solicitor, 77, Cornhill, E.C., and of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LEA BRIDGE DISTRICT GAS COMPANY.

ISSUE OF £14,000 NEW CAPITAL COMPRISING:
£4000 Four per Cent. Perpetual Debenture Stock,
£5000 Five per Cent. Preference Stock,
£5000 Consolidated Ordinary Stock.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 10, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

BIRTLEY IRON COMPANY,

ESTABLISHED 1820,

Owners of the Birtley Iron Works and Pelaw Main Collieries,

GENERAL ENGINEERS & IRONFOUNDERS.

Makers of Cast-Iron PIPES and CONNECTIONS for Gas, Water, Steam, Electrical, Sanitary, and other purposes; also TANKS, COLUMNS of every description, Hydraulic, Gas, and Colliery PLANT, &c.

Illustrated Catalogue, giving complete list of our manufactures, on application.

Works: BIRTLEY, CO. DURHAM.

Newcastle-on-Tyne Offices: MILBURN HOUSE.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: E. C. BROWN & CO., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the
MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

ALL the
BOYS CALORIMETERS
which have been in daily use in all the Official Testing-Stations in London for the last Three Years
WERE MADE BY
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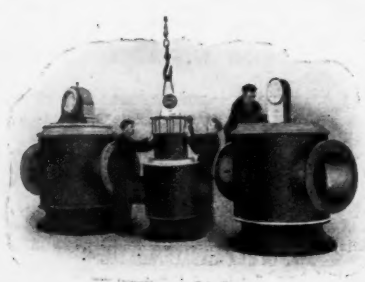

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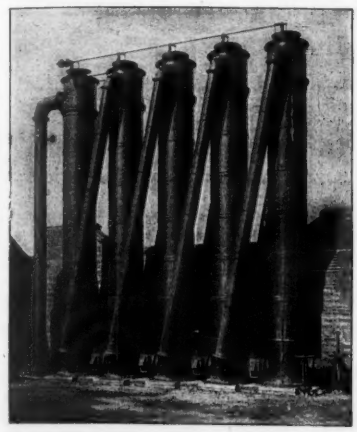

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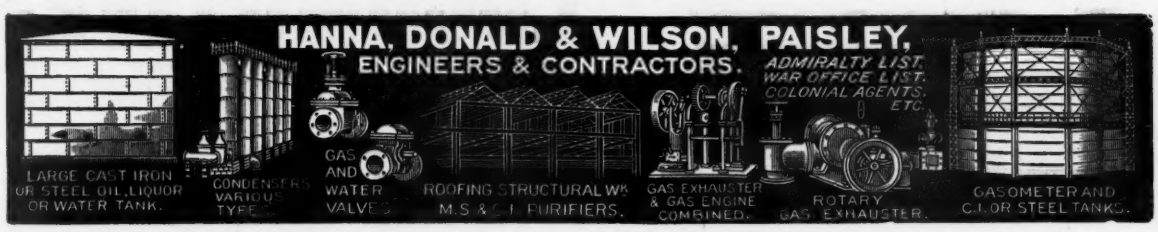
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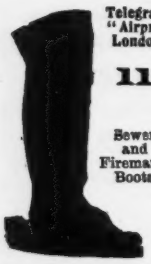

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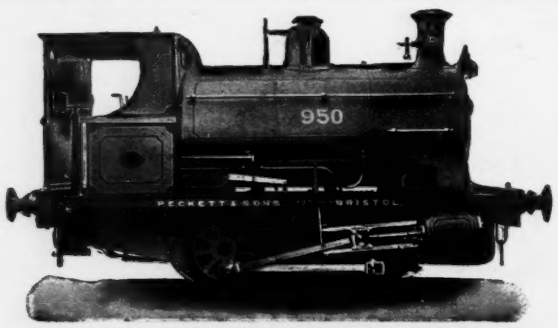

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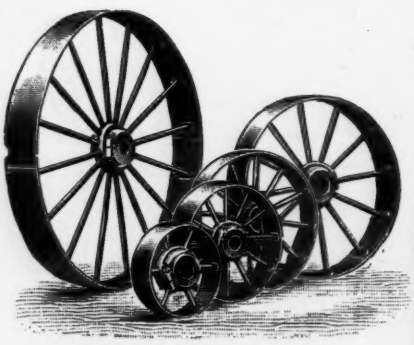

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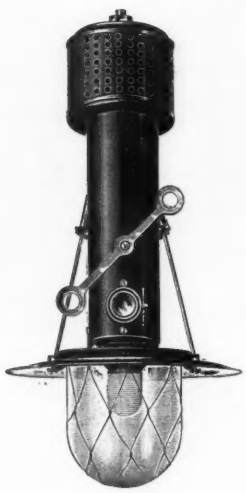

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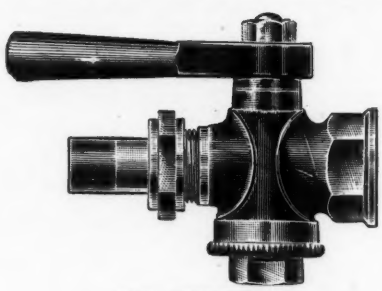

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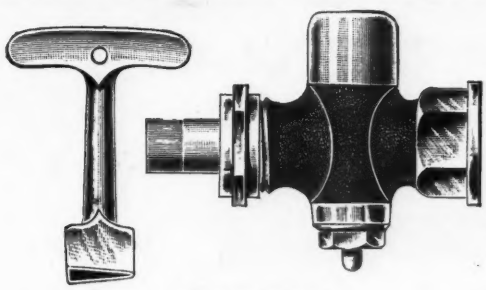

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WILL DISCHARGE A RETORT IN ONE OPERATION
LARGE NUMBERS IN USE.

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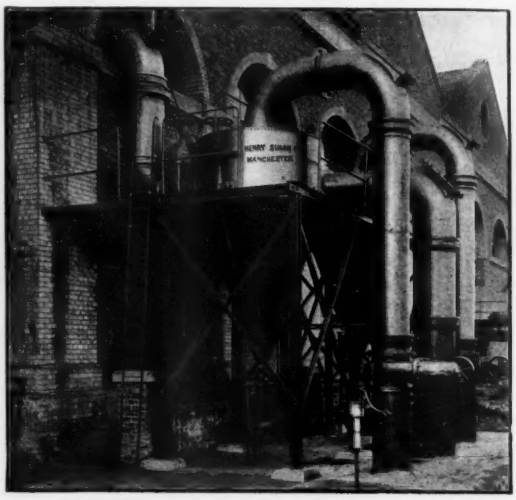

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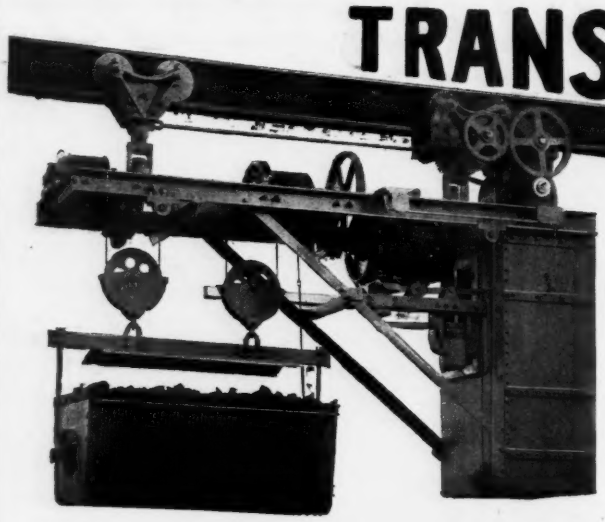
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Welsbach
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Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
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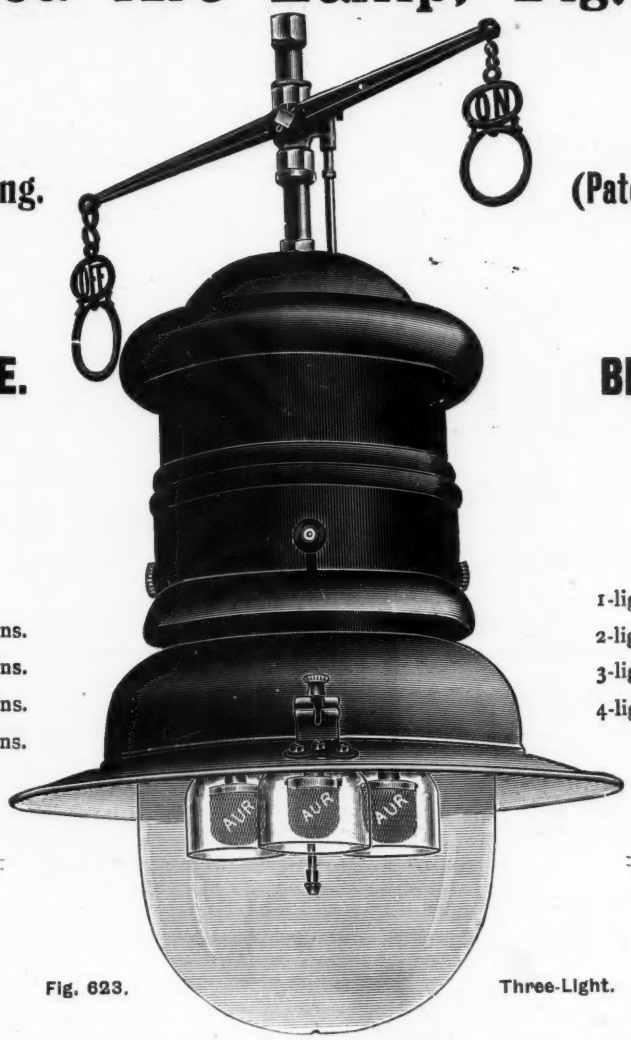

Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*		*1-Light.*	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**	Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**	Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made
Case contains . .	*80*	*18*	*18*	*12*	Welsbach Mantles, each **6d.** subject as usual.				

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

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INCREASES the Capacity of the Unit-Time.
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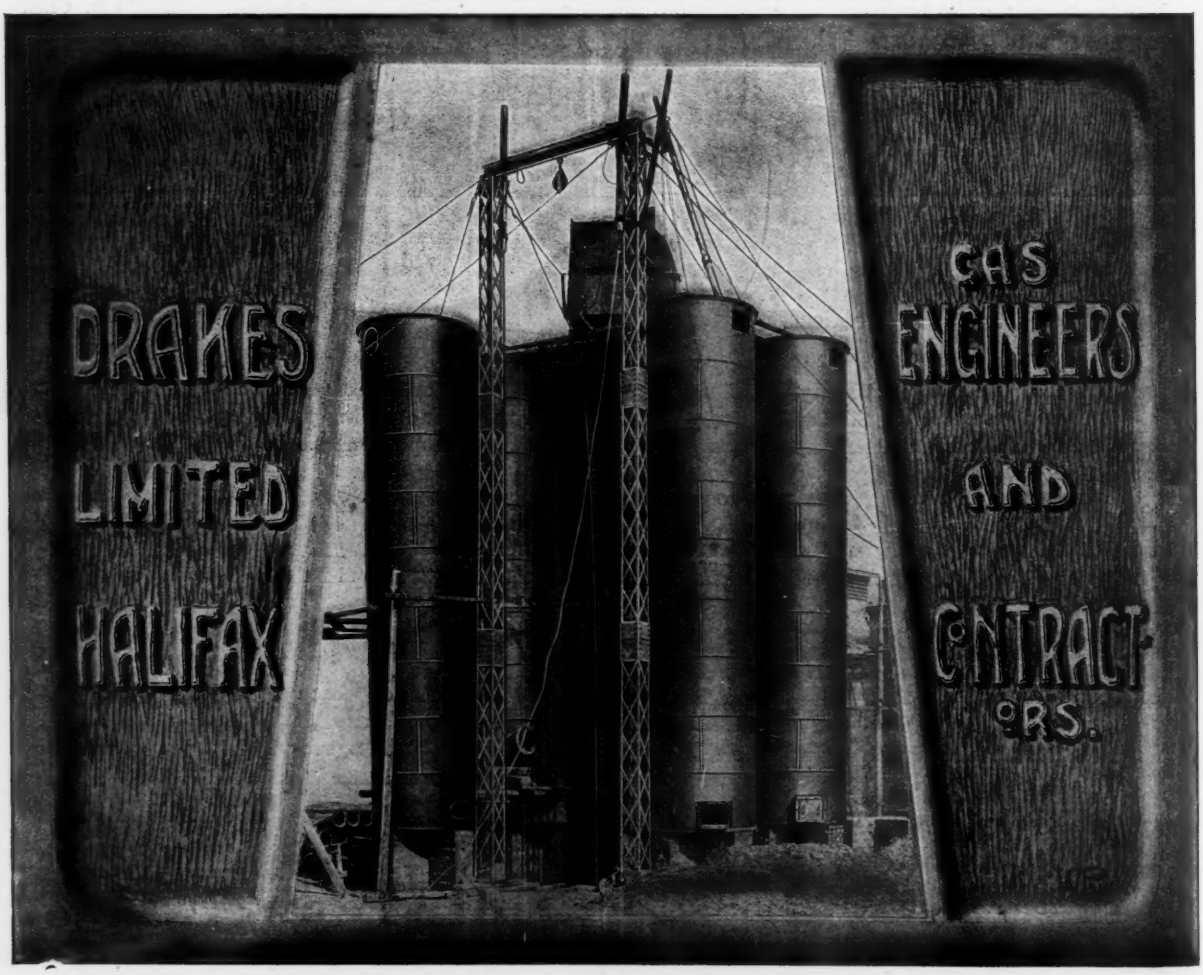

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MECHANICAL COAL HANDLING PLANTS

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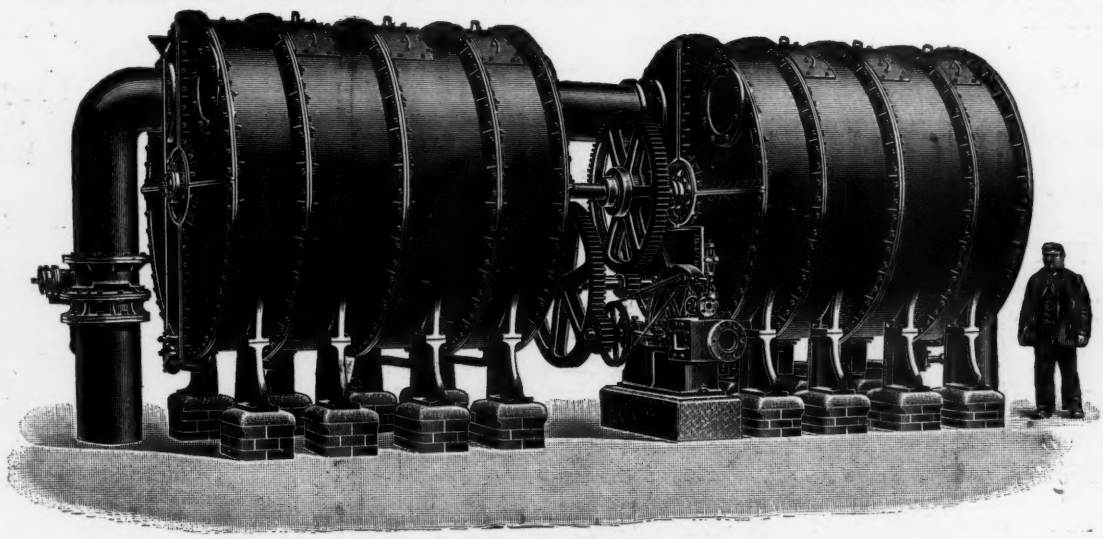

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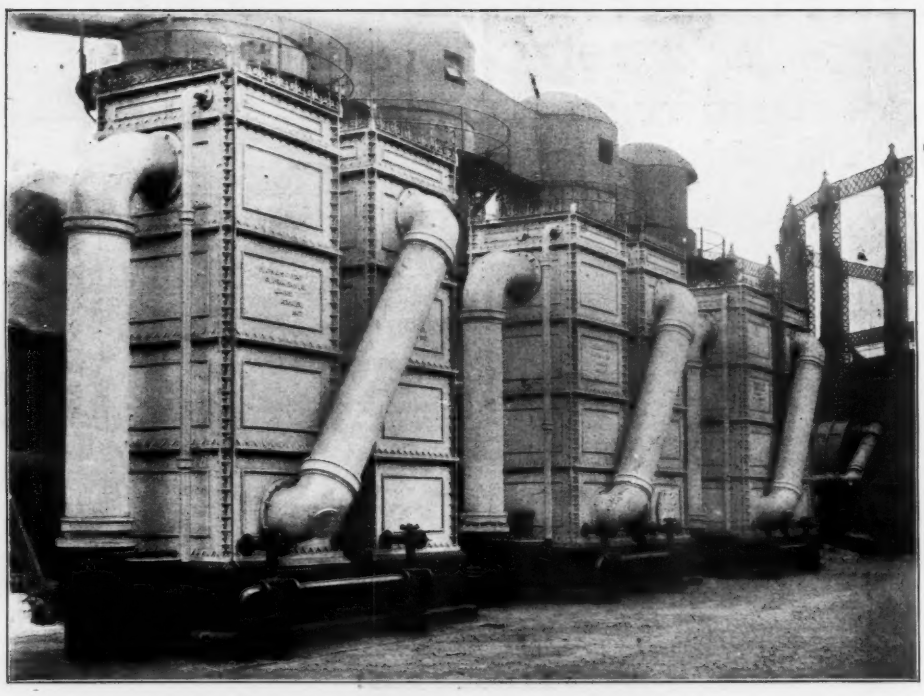

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